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ABSTRACT

Presented in the sourcebook for the teacher educator is the Four-D model (define, design, develop, and disseminate) to be used for developing instructional materials for training teachers of exceptional children. Listed at the beginning of chapters are instructional objectives; included when appropriate are guidelines, checklists, and flow charts. Given for use of the book are instructions such as reading chapter 1 for an overview, choosing a topic, and checking chapter objectives for essentialness to task accomplishment. Noted in the introduction are the transition in special education that requires teachers to demonstrate competency, the efficacy and validity of special training programs, and the role of the Four-D model. The stage categorized as "define" is described to be analytical and to involve five steps: front-end analysis (problems facing the teacher trainer), learner analysis, task analysis, concept analysis, and the specifying of instructional objectives. The next stage is seen to involve the design of prototype instructional material and to comprise four steps: construction of criterion referenced tests, media selection, format selection, and initial design for presentation of instruction through media such as tests, textbooks, audiotutorial models, and computer assisted instruction. The developmental stage is said to comprise modification of the prototype material through expert appraisal and developmental testing. Described for the final stage (disseminate) are summative evaluation, final packaging activities such as securing copyright releases, and diffusion. (MC)

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Instructional development for training teachers of exceptional children

A sourcebook

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Instructional development for training teachers of exceptional children

A sourcebook

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Center for Innovation
in Teaching the Handicapped

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Bloomington, Indiana

A joint publication of the Leadership Training Institute/Special Education, University of Minnesota; The Center for Innovation in Teaching the Handicapped (CITH), Indiana University; The Council for Exceptional Children (CEC), and The Teacher Education Division of CEC.

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Foreword

As its name implies, this book is a source of ideas and procedures for the development and dissemination of instructional materials for teacher preparation programs. Although it focuses on needs in the field of special education, this work can be used productively in other fields that lack sufficient or adequate instructional tools. The authors have brought together and graphically systematized a number of theoretical constructs and practical skills. Step by step, they have taken the reader from the determination of the need for new instructional materials, through the processes of creating and evaluating modules of instruction, to the mass production and distribution of the finished module. The purpose of the Sourcebook is to help the teacher educator use his hard-won expertise to produce instructional modules which can be shared with colleagues for the improvement of the field. The Sourcebook may well be the first resource of its kind in any area of education.

The emphasis on the dissemination of productive ideas was not included idly. It is a partial response to the paucity of processes in education for sharing ideas and procedures. Over the past two decades, many universities and other educational agencies have had substantial federal support for projects which, it was hoped, would reach a highly visible and exemplary state and produce "ripple effects" in other service centers, both near and far. Unfortunately, many programs, although highly innovative and rewarding, culminated in poorly edited, largely unread "final reports," or in not-quite-finished audio-visual or graphic materials, which could only be used by their producers. Although dissemination was an early goal for most of the projects, widespread sharing never seemed to materialize. Persons who have gone searching for "modules" or even minor products from handsomely supported projects almost uniformly netted nothing that they could use.

The failure to share the results of developmental work is particularly disastrous in relatively small fields such as special education. The absence of a mass audience does not encourage commercial initiative and, consequently, only a thin trickle of materials is produced for the market. Since units preparing special education personnel tend to be small, their resources tend to be limited. Furthermore, the resources that do exist in special education are unevenly distributed. As a result, some colleges have been able to afford lavish instructional materials while other colleges have struggled to maintain quality teaching with minimal tools. One of the reasons that resources and materials for teacher education have not been shared in the past is that colleges and universities were virtually forced to compete for federal funding. Thus, ideas were hoarded for grant possibilities rather than shared for instructional improvement.

Happily, this situation is changing. The federal government is increasingly stressing the coordination of plans among training centers and state agencies to meet carefully documented needs. In addition, teacher education in general is moving toward the explication of specific goals and a recognition that, for accreditation purposes, outcomes are more important than processes. As a result, the demand is growing for teaching modules that correspond to specific objectives in teacher education. Just as important, perhaps, is the move by the Office of Education to bloc training grants which may accelerate the improvement of teacher education.

Another obstacle in times past has been the lack of systems for recognizing and reinforcing good and generous performances in teacher education.

Research professors have had clear access to high-status channels for the dissemination of the products of research, mostly through peer-juried research journals and monographs. No comparable channels exist for teacher educators. Research publications have been given much weight in documenting faculty performance, which has led to individual promotions and other rewards. On the other hand, outstanding performances in teacher education have been difficult to document and have been given only cursory recognition. Obviously, some system for the dissemination of training materials is needed if excellent teaching abilities and innovations are to be given their due as a legitimate basis for professional rewards.

Fortunately, a new course is underway which may resolve some of the past problems and, at the same time, lead to more effective teacher preparation in the field of special education. As part of its mandate from the National Center for the Improvement of Educational Systems, U. S. Office of Education, the Leadership Training Institute/Special Education has initiated the publication of resource material (Reynolds & Davis, 1971, Reynolds, 1971) lately in cooperation with the Council for Exceptional Children (Deno, 1973). Other dissemination activities of CEC have been centered in its Teacher Education Division (TED). TED leaders, starting with Richard Schofer, William Carriker, and Herbert Prehm, saw their plans come to fruition in April 1973 when TED officially adopted policies on, and set in motion, a program for the dissemination of instructional modules and materials in the field of teacher preparation.

The Sourcebook is the first of what, I hope, will be a long series of instructional materials shared among colleges, universities, and other training centers for special education personnel. Additional materials are already in the planning stage and, thus, it may not be amiss to celebrate a new spirit of mutual support as well as a new surge in quality in our field. This form of "sharing," it is hoped, will add further strength to the Teacher Education Division of CEC and lead to other activities of equal importance.

It is most fortunate that Melvyn and Dorothy Semmel and Sivasailam Thiagarajan were willing and able to bring their competencies and commitments to this complex of activities. Their conception and realization of this Sourcebook are an outgrowth of their involvement in the BEH-supported Center for Innovation in Teaching the Handicapped at Indiana University.

Thiagarajan and the Semmels have created a systematic guide for materials development and evaluation which all of us in special education can build upon in constructing a dissemination system that eradicates the deficiencies of the past and offers opportunities for the future. The authors have exemplified the best of "sharing" in developing this work; they plan to implement it with correlative instruction modules in the near future.

I wish to express my appreciation to Don Davies, William Smith, Stewart Tinsman, Malcolm Davis, and Ed Moore, past and present staff officers of the National Center for the Improvement of Educational Systems, for giving me the opportunity to help bring this interesting and valuable Sourcebook to special educators.

Maynard C. Reynolds, Director
Leadership Training Institute/Special Education
University of Minnesota

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How to use the sourcebook

The objective of this sourcebook is to assist the reader in the design, development, and dissemination of instructional materials for training teachers of exceptional children. Specific instructional objectives are listed at the beginning of each chapter. Since it is anticipated that the instructional development competencies of readers will vary considerably, the chapters have been organized in modular form to permit their use at any appropriate stage of the developmental process. The following steps are suggested for maximizing the usefulness of the sourcebook:

1. Read Chapter 1 for an overview of the instructional development process.

2. Put the sourcebook aside and choose a topic on which you would like to develop an instructional material for teacher training.

3. Check the objectives for each chapter and decide whether they are essential to accomplish the task you have undertaken. For example, it is extremely unlikely that you will need to work through Chapter 16, "Computer-based formats," during an initial reading.

4. Compare your competencies with the objectives listed for the chapter. For example, you may already know how to state behavioral objectives or construct performance test items. Skip any chapter for which you have the competencies discussed.

5. Upon completing each chapter, apply the techniques to the design of your instructional material. This procedure provides an opportunity to use the recently acquired skill and also prepares you to make maximum use of the next chapter in your self-selected sequence.

6. Because the major objective of the sourcebook is to provide a comprehensive introduction to the entire instructional development process, each chapter covers only the fundamentals of the various development techniques. However, each chapter is laced with selected references, most of which are practical rather than theoretical. Use these references whenever necessary.

7. Review the suggestions in Chapter 9, "Format selection," and choose a suitable format for your instructional material. Depending upon the format you select, you will need to read only *one* of the seven format chapters.

8. At the end of stage 3, Develop, you may feel that the instructional development job is done. However, it is suggested that you go on to Stage 4, Disseminate, to learn the essentials of concluding an instructional project.

9. After you complete your first project, we hope you will find the sourcebook a valuable reference for future instructional development projects.

Chapter 1
Introduction

Objectives

1. Provide a rationale for instructional development for special education teacher training.
2. Trace the four stages in the development of an instructional material and list various steps in each stage.
3. Adapt the instructional development process to suit the limited support available to a teacher trainer on an initial small-scale project.
4. Explain how the transfer of instructional development skills to classroom instruction ultimately results in positive impact on the growth of handicapped children.

Aspects of three fields of practice in education have been integrated in this sourcebook. They are (a) instructional systems technology, (b) teacher education, and (c) special education. Our major objective is to stimulate the use of alternative instructional methods in the preparation of special education personnel through the introduction of the concepts, methods, and practices used by instructional developers. It is not our contention that the field of special education has unique potential for improvement through the adoption of the instructional development procedures outlined in this book. Rather, we believe that this field, like others in education, has a strong need to re-evaluate current methods for training personnel at the preservice and inservice levels to assure preparation that is meaningfully related to the education of handicapped children in our schools.

Teacher training in special education in transition

As in other fields of teacher training, special education is undergoing significant changes. In addition to the growing need to supply the nation with sufficient numbers of teachers to meet the demand for special educational services, there is an increasing emphasis on improving the quality of the teacher-training process and product. Teacher preparation programs, like the personnel they train, are being held accountable for their methods through the effects they produce; hence, the trend toward competency-based teacher certification. We are no longer satisfied that the successful completion of a list of lecture, recitation, and practicum courses is *prima facie* evidence of a teacher's competence in educat-

ing exceptional pupils. Just as significant, probably, is the growing tendency among trainees to question the value of course offerings, the validity of the skills and knowledge expected of them by training programs, and the competencies of their trainers. In many cases, student challenges to existing training programs have stimulated departmental evaluations of program goals and practices. Throughout the nation we find faculties examining current practices with an eye toward altering programs to effect a qualitative change in the education of exceptional children by improving the knowledge, skills, and attitudes of the personnel they train.

We hope to demonstrate in the chapters of this sourcebook that logical, creative, and empirically tested alternatives can solve some of the problems of providing more effective training for special education teachers. Inherent in systematic instructional development is a focus on the characteristics of the learner, the nature of the skills and knowledge the learner must acquire, the stipulation of objectives in behavioral terms, and the ways in which the attainment of objectives can be measured and certified. The approach also requires the trainer to analyze and evaluate the behaviors and concepts to be taught in the training program. Perhaps most importantly, the approach directly leads to assessable alternatives to traditional methods of training teachers. The reader is introduced to different media and shown how they are relevant to the instructional process, and he is furnished with a variety of instructional formats which, if utilized, should measurably alter the form and practices currently found in most training programs. Finally, the sourcebook is concerned with the methods by which successful instructional innovations can be exported to and adopted by the larger community of teacher educators in special education.

The efficacy and validity of training programs in special education

It is important to distinguish between the effectiveness of a teacher preparation program and the validity of the attitudes, skills, and knowledge derived from the program. In our view, a preparation program is effective if one can demonstrate that it has been instrumental in generating a relatively permanent change in the behavior of its trainees, and that this change is a function of the experiences the program has provided. To meet this criterion of effectiveness, the objectives of the program must be stipulated in behavioral terms, and the objectives must be appropriate to the entry behaviors of trainees. The program must describe and/or demonstrate the critical defining attributes of the training procedures so that replication can be assured. Further, the program should produce objective evidence for trainee attainment of the objectives. In other words, a program is deemed effective if it can be demonstrated that it has met its objectives as a function of a set of clearly definable experiences.

Program effectiveness is a necessary but not sufficient criterion for improving special education through the teacher's behavior. We can clearly define our training objectives in behavioral terms and meet them through effective training procedures—but the objectives may have little or no relation to successful work with exceptional pupils in the schools. For example, a training program may focus on providing a trainee with all necessary knowledge of the symptoms that identify a dyslexic child. However, this knowledge is of little use if the trainee never learns how to teach the child to read.

This sourcebook does not focus on the aptness or utility of the attitudes, skills, or knowledge which

training programs establish as their objectives. Rather, it assumes an existing or evolving commitment to what is important to transmit to trainees. The book may, however, offer the reader considerable assistance in clarifying the ways programs might approach the difficult task of selecting training objectives that can be validated against teacher effects with exceptional children. A primary concern here is to provide teacher trainers with a methodology that supports the development of effective training programs.

A model for instructional development

In recent years, a number of models for instructional development have employed the common steps of analysis, design, and evaluation (Twelker, Urbach, & Buck, 1972). The systems-approach model around which this sourcebook is organized is based upon these earlier models and upon actual field experience in designing, developing, evaluating, and disseminating teacher-training materials in special education. We have called our systems-approach the **Four-D Model** because it divides the instructional development process into the four stages of **Define**, **Design**, **Develop**, and **Disseminate** (Fig. 1.1). A brief description of each stage follows:

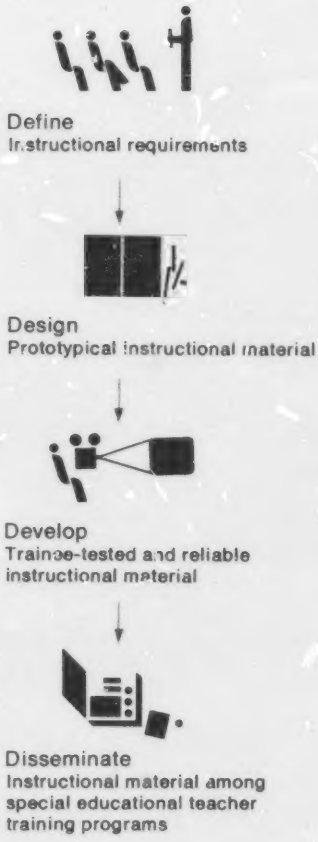

Figure 1.1
Four-D model

Stage I: Define

The purpose of this stage is to stipulate and define instructional requirements. The initial phase is mainly analytical. Through analysis, we prescribe objectives and constraints for the instructional materials. The five steps of the stage are shown in Figure 1.2.

Front-end analysis is the study of the basic problem facing the teacher trainer: to raise the performance levels of special education teachers. During this analysis the possibilities of more elegant and efficient alternatives to instruction are considered. Failing them, a search for relevant instructional materials already in circulation is conducted. If neither pertinent instructional alternatives or materials are available, then the development of instructional material is called for.

Learner analysis is the study of the target students —special education teacher trainees. Student characteristics relevant to the design and development of instruction are identified. The characteristics are entering competencies and background experiences; general attitude toward the instructional topic; and media, format, and language preferences.

Task analysis is the identifying of the main skill to be acquired by the teacher trainees and analyzing it into a set of necessary and sufficient subskills. This analysis ensures comprehensive coverage of the task in the instructional material.

Concept analysis is the identifying of the major concepts to be taught, arranging them in hierarchies, and breaking down individual concepts into critical and irrelevant attributes. This analysis helps to identify a rational set of examples and nonexamples to be portrayed in protocol development.

Specifying instructional objectives is the converting of the results of task and concept analyses into behaviorally stated objectives. This set of objectives provides the basis for test construction and instructional design. Later, it is integrated into the instructional materials for use by instructors and teacher trainees.

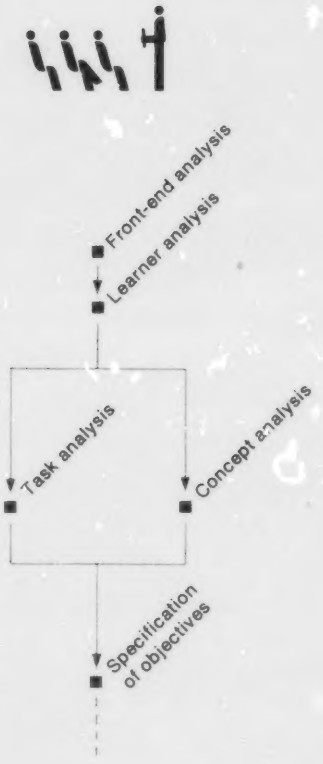

Figure 1.2
Stage I: Define

Stage II: Design

The purpose of this stage is to design prototype instructional material. This phase can begin after the set of behavioral objectives for the instructional material has been established. Selection of media and formats for the material and the production of an initial version constitute the major aspects of the design stage. The four steps in this stage are shown in Figure 1.3.

Constructing criterion-referenced tests is the step bridging Stage I, **Define**, and the **Design** process. Criterion-referenced tests convert behavioral objectives into an outline for the instructional material.

Media selection is the selection of appropriate media for the presentation of the instructional content. This process involves matching the task and concept analyses, target-trainee characteristics, production resources, and dissemination plans with various attributes of different media. Final selection identifies the most appropriate medium or combination of media for use.

Format selection is closely related to media selection. Later in this sourcebook, 21 different formats are identified which are suitable for designing instructional materials for teacher training. The selection of the most appropriate format depends upon a number of factors which are discussed.

Initial design is the presenting of the essential instruction through appropriate media and in a suitable sequence. It also involves structuring various learning activities such as reading a text, interviewing special education personnel, and practicing different instructional skills by teaching peers.

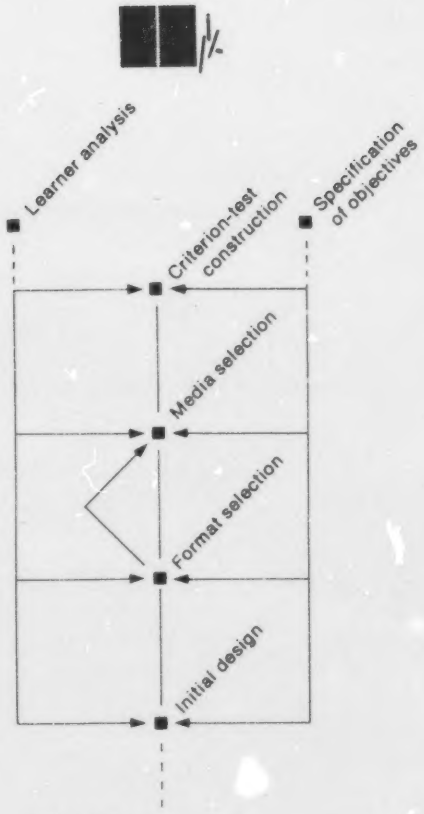

Figure 1.3
Stage II: Design

Stage III: Develop

The purpose of Stage III is to modify the prototype instructional material. Although much has been produced since the **Define** stage, the results must be considered an initial version of the instructional material which must be modified before it can become an effective final version. In the development stage, feedback is received through formative evaluation and the materials are suitably revised. The two steps in this stage are shown in Figure 1.4.

Expert appraisal is a technique for obtaining suggestions for the improvement of the material. A number of experts are asked to evaluate the material from instructional and technical points of view. On the basis of their feedback, the material is modified to make it more appropriate, effective, usable, and of high technical quality.

Developmental testing involves trying out the material with actual trainees to locate sections for revision. On the basis of the responses, reactions, and comments of the trainees, the material is modified. The cycle of testing, revising, and retesting is repeated until the material works consistently and effectively.

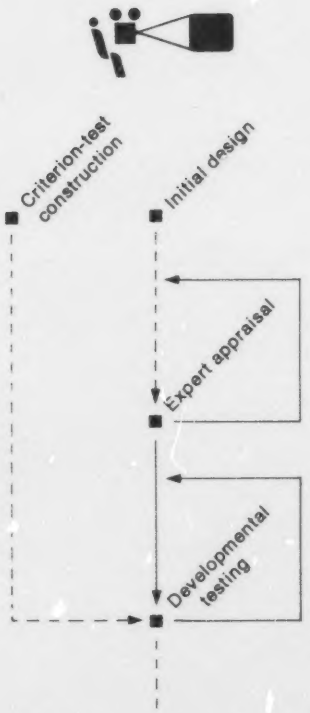

Figure 1.4
Stage III: Develop

Stage IV: Disseminate

Instructional materials reach their final production stage when developmental testing yields consistent results and expert appraisal yields positive comments. The three steps in this stage are shown in Figure 1.5.

Before disseminating the materials, a summative evaluation is undertaken. In its *validation testing* phase, the material is used under replicable conditions to demonstrate "who learns what under what conditions in how much time" (Markle, 1967). The material is also subjected to professional examination for objective opinions on its adequacy and relevance.

The terminal stages of *final packaging*, *diffusion*, and *adoption* are most important although most frequently overlooked. A producer and a distributor must be selected and worked with cooperatively to package the material in an acceptable form. Special efforts are required to distribute the materials widely among trainers and trainees, and to encourage the adoption and utilization of the materials.

Figure 1.5
Stage IV: Disseminate

The teacher trainer as an instructional developer
Small scale instructional development

Many teacher trainers do not have the time, inclination, or resources to mount an ambitious instructional development project involving all the stages described. However, the process is not so complicated as it initially appears. As a teacher trainer, you have undoubtedly undertaken an informal analysis of your subject-matter area and the characteristics of your trainees, and probably you have designed a number of test items, class assignments, and reading lists. With this head start, you are in a position to bypass or rapidly complete the **Define** stage. In the **Design** stage, several simple but effective formats are available for the part-time instructional developer. A reading list is an example of such a format. Its design merely requires the specification of instructional objectives and the compilation of a list of various textual materials, handouts, journal articles, and other existing documents, which can be duplicated in any one of several ways and given to the trainees.

More comprehensive instructional packages can be effectively developed over an extended time period. If, during each semester, we concentrate on preparing instructional materials for one small unit, we can gradually accumulate enough materials to make the course self-contained. Working in this way, we do not need to assemble a special group of teacher trainees for the developmental testing of the materials. During the first semester, the materials are tried out with the trainees already enrolled; the next semester is spent in revising the materials; and the semester after that is reserved for the validation testing of the materials.

Large-scale instructional development projects

Although the steps in the development process are the same for large-scale as for small-scale projects, time and manpower requirements increase according to the complexity and length of instructional content.

The first step in large-scale development is the assembly of an instructional development team. Assuming that you are primarily a special educator, the first team person you will need is an instructional developer or a media specialist. For certain steps of the developmental process, you will also need an evaluator. In addition, you will need a target-trainee population for testing, other teacher trainers for expert appraisal, graphic artists and writers for designing the prototype version, and a data analyst. In planning a large-scale project, it is easy to overlook the first and last stages (defining instructional requirements; disseminating the finished product). As each stage plays a vital role in the development process, it is important to allot time and resources appropriately.

The selected bibliography at the end of this chapter provides an overview of current instructional development literature; it should be a useful introduction to the varied aspects of instructional systems technology for both small- and large-scale development projects.

The teacher trainer as a model

One of the more effective means of maximizing learning is to provide students with appropriate models of the terminal behaviors that define our objectives. Teacher educators too frequently ignore this principle in the conduct of their training programs although they support it in the abstract.

In working with exceptional pupils, the teacher is usually expected to establish his objectives carefully and to plan an instructional program only after he has completed an analysis of the learners and the organization of the content to be taught. He is expected to furnish the children with a psychological and physical environment that will maximize both intrinsic and extrinsic motivations for learning; to carefully select and develop materials that will match the learners' characteristics; and to provide appropriate instructional formats for the children. Then he is expected to evaluate the progress of his pupils both formatively and summatively. Unfortunately, these expectations are not generally reinforced by the models which are provided by the teacher trainers.

Another way to approach the contents of this sourcebook is as an outline of a training program model for special education teacher trainees to emulate. The following diagram (Fig. 1.6) illustrates the hypothesized process by which the adoption of the instructional development model of this book could operate to produce meaningful effects in exceptional pupils.

The synthesis of the principles and practices of instructional programing with teacher training in special education may be expected to result in (a) improving the effectiveness of the training program in meeting its objectives, and (b) showing a positive impact on the growth of exceptional pupils through the trainee's application of the instructional model provided by the training program.

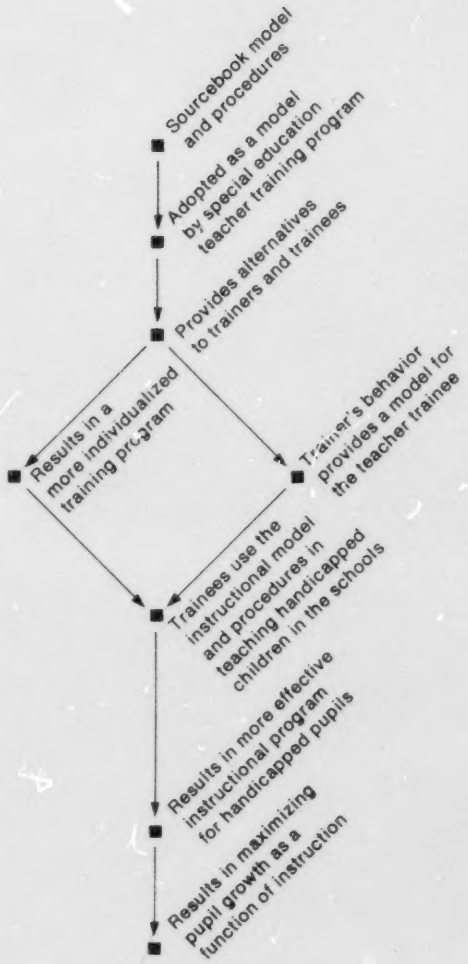
Sourcebook model and procedures
Adopted as a model by special education teacher training program
Provides alternatives to trainers and trainees
Results in a more individualized training program
Trainer's behavior provides a model for the teacher trainee
Trainees use the instructional model and procedures in teaching handicapped children in the schools
Results in more effective instructional program for handicapped pupils
Results in maximizing pupil growth as a function of instruction

Figure 1.6.
The Sourcebook as a model for teacher trainers and trainees.

Selected bibliography on instructional development

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Johnson, R. B., & Johnson, S. R. *Assuring learning with self-instructional packages, or . . . up the up staircase.* Chapel Hill, N. C.: Self-Instructional Packages, 1971.

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Merrill, M. D. (Ed.). *Instructional design: Readings.* Englewood Cliffs, N. J.: Prentice-Hall, 1971.

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Popham, W. J., & Baker, E. L. *Systematic instruction.* Englewood Cliffs, N. J.: Prentice-Hall, 1970.

Stage I
Define

Chapter 2
Front-end analysis

Objectives

1. Analyze performance problems in teaching exceptional children in terms of a discrepancy between the criteria and the actual behaviors of teachers.
2. Identify those performance problems which lend themselves to instructional solutions.
3. Locate available instructional materials by systematically searching for appropriate references.
4. Review instructional materials by using Checklist 2.1, and decide whether to adopt, adapt, or reject.

Succeeding chapters of this sourcebook deal with various stages of the Design, Development, and Diffusion of instructional materials. This chapter asks a preliminary question: Is this instructional material really necessary? Teacher trainers have been known to overteach on occasion, a tendency that may extend also to the preparation of instructional materials. We know that the development of such materials is a time-consuming job requiring considerable resources and energy. Hence, it is extremely wasteful to design materials which are based on questionable content or which simply replicate existing materials that are acceptable in both form and substance.

In this chapter, therefore, we shall attempt to place instructional development in its proper perspective as one of the various problem-solving techniques available to the teacher trainer in special education. This point of view builds on Harless's (1971) concept of "front-end analysis" and Mager and Pipe's (1970) principles of performance problem solving.

When are instructional materials required?

When does the need for an instructional material arise? For that matter, when does the need for instruction arise in the field of teacher training? The answer is, when a teacher trainee's performance is below a defined criterion level.

If a trainee can already perform adequately in a given job, instruction in that area is totally superfluous. When a discrepancy is found between the criterion and the actual performance, we naturally assume that the trainee must be taught the absent skill or concepts. But performance discrepancies in

trainees do not necessarily indicate deficient skills or knowledge. Indeed, performance discrepancies sometimes result from lack of motivation or from the presence of physical or psychological obstacles (Harless, 1971), problems which have nothing to do with instruction.

If, for example, a teacher of educable mentally retarded (EMR) children fails to make use of individual standardized reading test scores, the teacher trainer or supervisor may identify a performance discrepancy. Thus, in this example,

Criterion performance	**Actual performance**
Effective use of test scores	Lack of use of standardized test scores

the difference between criterion and actual performance is the performance discrepancy. It could be the result of one or more of the following causes:

Environmental causes. The teacher is already overworked. The task of obtaining standard test profiles is arduous and full of red tape.

Motivational causes. The teacher might not like the complicated computations required to interpret the standardized reading test data. He may not believe that standardized testing is appropriate for his exceptional pupils and he may think it inadvisable to establish an expectancy based on reading assessment.

Lack of skills and knowledge. The teacher might not know how to interpret test profiles.

In both preservice and inservice teacher-training situations in special education, the cause of a performance discrepancy can be traced to an interaction of various factors. Each type of discrepancy requires a different solution. Basically, a motivational problem will need effective management of contingencies, and an environmental problem will lend itself to a re-engineering of the situation and conditions. Attempting to solve these problems through instruction may actually create additional problems.

Even when instruction is strongly suggested, it is not always necessary to begin immediately to design and develop instructional materials. A number of alternative instructional approaches can be tried first to find the one that optimally suits the given needs and conditions. Using already available instructional materials is obviously the most efficient approach. Yet, in the field of teacher training, we frequently "reinvent the wheel." Unfortunately, at this time, no comprehensive guide to instructional materials for special education teacher training is available and we are dependent on word-of-mouth information from colleagues, serendipitous selections from publishers' catalogs, and guides and bibliographies geared to related educational pursuits.

Locating instructional materials

Many promising developments are occurring in the field of special education today. One possible outcome of these developments may be the centralization of information on special education teacher training product development in the near future. Until such efforts are fully realized, however, alternative techniques for ferreting out useful training materials are necessary.

Many standard references, if used creatively, are good sources of information on new developments. The ERIC System may be queried systematically by using the *Thesaurus of ERIC Descriptors* (1969) to obtain the specific terms that describe your interests. For example, if you need instructional materials for training teachers of physically handicapped children,

use synonyms from the *Thesaurus* for terms such as "disabled," narrower terms such as "amputees" or "orthopedically handicapped," and related terms such as "perceptual handicapped," "physical therapy," "prosthesis," and "special health problems." Select the terms that come closest to identifying your area of interest and review the abstracts cited for them, as well as the citations for "teacher education." Computer searches of the ERIC System can be made at several universities and through the main CEC/ERIC Center (Washington, D.C.). Since the search is more than likely to yield information on some university and R & D Center demonstration projects, the next step is to write to the original developers for information on the availability of materials.

Numerous secondary reference works can be used in a similar manner. In the annotated bibliography at the end of this chapter, some of these works are listed along with sources that abstract completed and available training materials.

Assessment of instructional materials

If your search has yielded materials that appear to be suitable for your specific needs, review them for quality as well as appropriateness. Checklist 2.1 is designed to help identify the critical elements of such materials.

Checklist 2.1
Assessment of instructional materials for training teachers of exceptional children

Directions: In multiple-choice items, check as many as are appropriate. In other items, indicate the approximate position of the instructional materials along the seven-point scale.

Objectives

1. Is the material accompanied by a list of objectives?

   ( ) Yes ( ) No

2. The objectives are stated in:

1	2	3	4	5	6	7
ambiguous global terms						specific behavioral terms

3. These objectives appear to be derived from an analysis of:
   - _____ the special teachers' tasks
   - _____ the needs of handicapped children
   - _____ current trends in special education
   - _____ the demands of the subject-matter area

4. These objectives:

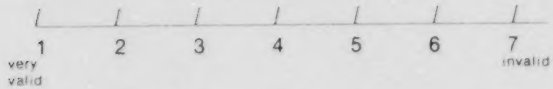
1	2	3	4	5	6	7
coincide with realities of teaching exceptional children						are totally irrelevant to teaching exceptional children

5. Overall evaluation of objectives:

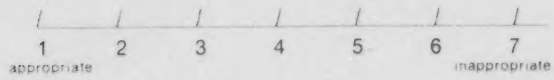
1	2	3	4	5	6	7
appropriate						inappropriate

Tests and evaluation

1. The material is accompanied by:
   - _____ entry knowledge test
   - _____ final criterion test
   - _____ pretest
   - _____ transfer test
   - _____ other
2. These tests emphasize the measurement of:
   - _____ cognitive skills
   - _____ psychomotor skills
   - _____ affective outcomes
   - _____ other
3. Types of test items and measuring instruments:
   - _____ paper-and-pencil, objective
   - _____ paper-and-pencil, essay
   - _____ scales and questionnaires
   - _____ performance tests
   - _____ transfer assignments
   - _____ observation systems
   - _____ other
4. How validly does the test measure the stated objectives of the material?

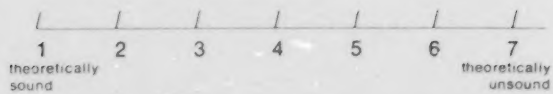


5. Overall evaluation of tests:

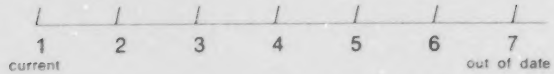


Subject-matter content

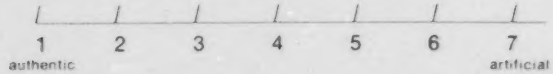
1. The treatment of content is:



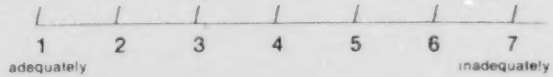
2. Usage of terms and conventions:



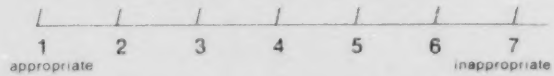
3. Examples used in the material:



4. Instructional objectives are covered by the content:

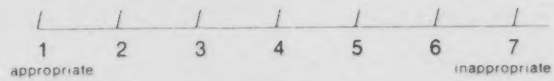


5. Overall evaluation of subject-matter content:



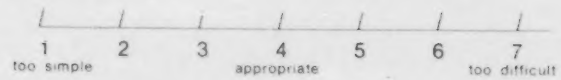
Relevance to teacher trainees

1. Level of language:



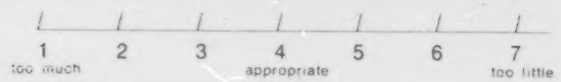
2. Teacher trainee is required to participate:
   - _____ actively
   - _____ passively
   - _____ individually
   - _____ in small groups
   - _____ in large groups
   - _____ other

3. Difficulty level:

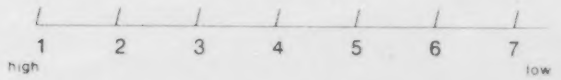


4. Sequence:
   - _____ logical
   - _____ psychological
   - _____ rigid
   - _____ flexible: under learner control
   - _____ other

5. Amount of practice and review:



6. Overall evaluation of relevance:



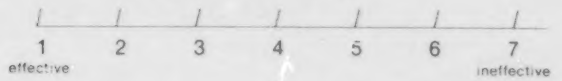
Packaging

1. Type of materials:

2. Adequacy of packaging:

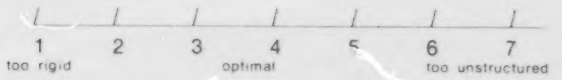
3. Package contains these adjunct materials:
   - _____ list of references
   - _____ follow-up activities
   - _____ instructor's manual
   - _____ tests and measuring instruments

4. Overall evaluation of packaging:

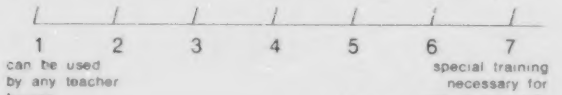


Recommended procedure for use

1. Flexibility:

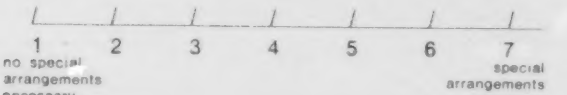


2. Training:



3. Equipment:

4. Logistics:



5. Overall evaluation of recommended procedure for use:

1	2	3	4	5	6	7
efficient						inefficient

Final recommendation

_____ Adopt. The material is usable.
_____ Adapt. The material may be used with some modifications.
_____ Reject. The material is *not* usable.

To develop or not to develop? Making a final decision.

Based upon your critical appraisal of the material, you may make any one of the following decisions:

To Adopt: if the instructional materials meet your objectives.

To Adapt: if the instructional materials can be modified to meet your training needs.

To Reject: if none of the available instructional materials meet your training requirements. You will have to develop your own materials.

Although the instructional development procedure outlined in this sourcebook is designed to be of maximum use in the development of new materials, it may also be of help in adopting or adapting existing materials. For example, if you decide to adopt existing instructional materials, you will still need an instructional analysis, a design of an instructional-management format (e.g., providing the learner with a hierarchy of objectives keyed to various instructional materials or constructing a set of criterion tests), and formative and summative evaluations. Procedures for formative evaluation, which are outlined in two of the later chapters, are useful for pinpointing weak areas and making revisions, if you decide to adapt existing materials.

The processes and stages of front-end analysis are illustrated in Figure 2.1.

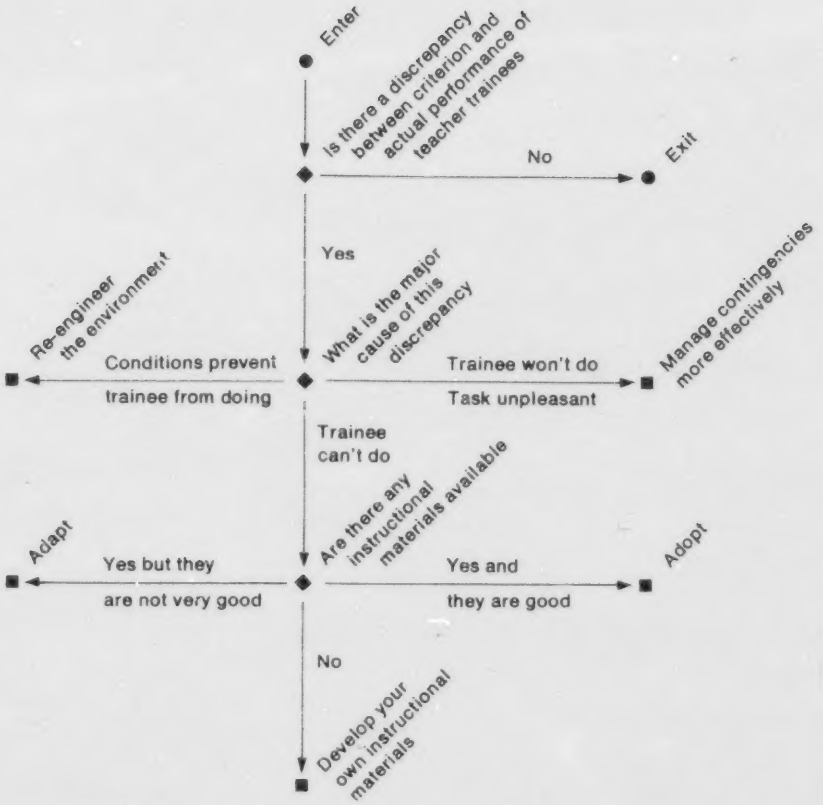


Figure 2.1
Front-end analysis

Selected bibliography of instructional development reference sources and media references

1. General and special education references

Council for Educational Development and Research, *CEDAR Catalog*. Center for Educational Development and Research, Denver, Colorado, 2 vols., 1972.

A two-volume compilation of selected research and development programs and products from ten national educational laboratories and nine university-based research and development centers. Both available and anticipated products are listed. Areas covered include school organization and administration, early childhood, elementary, secondary, higher education, teacher education, urban, vocational education, and basic research.

Current Index to Journals in Education (CIJE). New York: CCM Information Corp. Monthly since 1969.

An index to over 500 education and education-related journals. Indexed with subject descriptions from the *Thesaurus of ERIC descriptors*.

Research in Education. National Center for Education Communication. U. S. Department HEW, Office of Education. Monthly since 1966.

A monthly abstract journal announcing recently completed research and related reports in the field of education. RIE is indexed with subject descriptors from the *Thesaurus of ERIC descriptors*.

How to Conduct a Search Through ERIC, ED 036 499, microfiche 65c, hardback copy $3.29. Available through the ERIC Document Reproduction Service.

Exceptional Child Education Abstracts. CEC Information Center (CEC, ERIC Clearinghouse), Arlington, Va. Quarterly since 1969.

A quarterly, indexed publication of abstracts of special education documents that are stored in the CEC Information Center. Indices cumulate annually by subject, author, and title.

2. Instructional materials for teacher training references

Berger, A. C., Tonjes, M. J., Abbott, A. R., & Spino, W. D. *Florida Center for Teacher Training Materials Annotated Catalog of Teacher Training Materials*. Coral Gables, Florida. Florida Center for Teacher Training Materials, University of Miami, 1972. 321 pp.

An annotated catalog of competency-based teacher training materials. All materials are classified under one of 29 teacher competencies, e.g., generic teaching skills, language arts, reading, etc. Source index lists materials by producer or developer.

Information provided for each module annotated in the catalog includes title, author, publisher or developer, teacher competencies emphasized in the module, brief description of the material, intended consumer, cost, number of pages, estimated time to completion, and nature of the audio-visual materials included.

Houston, W. R., et al. (Eds.) Resources for *Performance-Based Education*. Albany, N.Y.: State Education Dept., University of the State of New York. March, 1973.

Probably the most useful catalog of instructional resouces for teacher education to date. It is an indexed and annotated listing of instructional materials in all media and formats, except textbooks.

Korba, W. L., Cawley, J. F., & Pappanikou, A. J. *Catalog of Decision System Films.* University of Connecticut, Storrs, Connecticut, 1972.

A catalog of special education training films produced at University of Connecticut. Each film presents a problem area in general and special education and is intended to provide a common basis for a discussion and study which should follow viewing. Some topics: academic freedom, superintendent selection, special education and the law, special education budget cut, teachers' union, special education placement, and others.

Blatt, B. (Ed.) *Selected Media Reviews 1970-1973.* Reston, Va.: Council for Exceptional Children, 1973.

Reprints of Media Reviews appearing in *Exceptional Children.* Includes mainly book reviews, with some reviews of films and other media. Reviews are detailed, some with authors' comments on the review. CEC updates these reprints periodically.

Meierhenry, W. C. (Ed.) *Mediated Teacher Education Resources: Supplemental Media Resources for Pre-service and In-service Teacher Education Programs.* Washington, D.C.: American Association of Colleges for Teacher Education, 1970.

An annotated bibliography, prepared by the AACTE Subcommittee on Education Technology in Teacher Education. The references are classified by media only. There is no breakdown of listings by subject area. It is a good source for selecting mediated teacher training materials currently in circulation.

Zuckerman, D. W., & Horn, R. E. *The guide to simulation games for education and training.* Cambridge, Mass.: Information Resources, 1970.

An extensive informational guide to games and simulation games indexed by subject, author, title, and producer. The index for each subject division contains information on target population, number of players, and time required for each game.

3. Media references

NICEM Indexes. National Information Center for Educational Media (NICEM), University of Southern California, University Park, Los Angeles, California 90007.

An audio-visual reference series. Each index covers educational materials in six different media. Vocational and technical education, psychology, and health and safety education are covered in three separate multimedia indices. All entries are annotated and a subject heading outline is included. Detailed and relatively expensive, the series is suitable as an A.V. library reference source.

Westinghouse Learning Corporation. *Learning Directory.* 7 Vol. New York, 1970. 6700 pp. $90.

A comprehensive guide to teaching materials at all levels, including print and nonprint materials.

Chapter 3
Learner analysis

Objectives

1. Identify various types of target trainees for whom materials for teaching exceptional children are to be developed.
2. Describe the process of learner analysis and relate it to other steps in instructional development.
3. Analyze characteristics of the target population relevant to instructional development.

Learner analysis is the preliminary stage of instructional development in which the characteristics of the target students which are relevant to the design of materials are identified. It is important for trainers to remember that target students are not exceptional children but their teachers, either preservice or inservice trainees. The target students also may be other important persons involved in the education of exceptional children: administrators of special education programs, resource teachers, consulting teachers, school principals, teachers' aides, and parents. Training materials can be designed for groups of any of these persons providing their relevant characteristics are taken into account.

Who are the learners?

Ideally, instructional materials should be tailor-made for the individual trainee. However, the ideal may result in over-individualization as the more materials are individualized the less appropriate they are for other students. Thus materials designed specifically for one teacher trainee may be relatively ineffective in meeting the needs of other trainees. At the other extreme are materials which are designed for all actual and potential teachers in special education. The effectiveness of such materials may be less than desirable because to be suitable for so broadly defined an audience, the material is necessarily very general in nature. Hence it is essential that the definition of the target students be broad enough to permit some generalization of the material but not so broad as to reduce the material's effectiveness. The more carefully the target students are identified, the greater the number of them who

will find the material effective, although not necessarily each to the same extent.

Any given set of target students shares a number of unique characteristics that differentiates it from other groups. Yet, within this group, there can be distinguished subgroups differing from each other. Therefore, an analysis of a group of learners must focus on not only the similarities but the differences characterizing the group. Analysis should indicate both the "average" set of characteristics and its "spread." If, for example, we identify two clear-cut subgroups in the target population, the development of two different forms of training materials may be useful. If the group differs on only one characteristic, variety of background experience, for instance, the training materials can still be useful for the whole group if additional and more varied examples are added.

Why learner analysis? Learner analysis directly affects all succeeding stages of instruction development. Learners' preferences determine media and format decisions and learner characteristics dictate such factors as language, style of presentation, choice of examples, size of learning steps, and nature of sequence. Learner analysis helps to insure that criterion tests are not contaminated by irrelevant factors. To a large extent, final packaging and dissemination also depend upon the characteristics and preferences of trainees.

What is to be analyzed? Although thousands of characteristics differentiate individual students and target groups, many are of trivial importance insofar as the design of instructional materials is concerned. The variables in the following learner-analysis checklist for teacher training materials in special education were selected on the basis of extensive developmental experience.

Checklist 3.2
Learner-analysis for the development of teacher-training materials in special education

Subject-matter competence

1. At what levels are the trainees' current knowledge and skills in the subject-matter area?
2. What background experiences do the trainees have in the subject-matter area?
3. Are the trainees likely to have any major misconceptions in the subject-matter area?

Attitudes

4. What are the general attitudes of the trainees toward the instructional content? Are there any subtopics within the content toward which the trainees are likely to feel very positive or very negative?
5. What preferences for instructional format and media do the trainees have?

Language

6. What is the language level of the trainees? How much of the specialized terminology is in their vocabularies?
7. What preferences for style of language (e.g., conversational or scholarly) do the trainees have?

Tool Skills

8. Do the trainees have any sensory-perceptual deficiencies that will require special attention?
9. Can the trainees handle the instructional materials and equipment?

How to conduct a learner analysis

Learner analysis is the identification of the learners' *actual* entry characteristics as opposed to the ideal (or prerequisite). When the target students are enrolled, the following informal techniques may be employed to perform a learner analysis.

☐ Recall. It is extremely likely that, as a teacher trainer, you have considerable experience with target students. Systematic use of the checklist should aid in the recall and listing of various relevant learner characteristics.

☐ Interviews with other teacher trainers. Tap the experiences of other teacher trainers by informally interviewing them. By carefully selecting a variety of special educators, a better picture of the diversity of the target students can be obtained.

☐ Research literature. Selected studies on the characteristics and attitudes of special education teacher trainees are listed at the end of this chapter. These studies may help interested trainers to obtain data-based listings of trainee characteristics.

☐ Interviews with the learner. Through face-to-face interviews or by administering a self-report questionnaire to trainees, a list of their relevant characteristics may be obtained.

☐ Criterion test. Perhaps the most important learner characteristic in the preparation of instructional material is the extent to which the terminal behavior has already been acquired. To pinpoint exactly the level of the learner on the continuum of objectives, a criterion test is administered to a random sample of the target students.

Sample learner analysis

The following is an example of the application of the learner-analysis technique outlined in Checklist 3.2 to preservice teacher trainees enrolled in a typical methods course. It is from a training module on instructional games entitled, *Let's Design Games that Teach Handicapped Children* (Thiagarajan, 1970).

Subject-matter competence. Trainees have a considerable theoretical knowledge of different types of handicapped children and special classrooms. They are knowledgeable enough in specific curricular areas to work with a topic for instructional game design. They have heard about instructional games and have seen them being used in special classrooms. However, very few of them have considered the possibility of designing a game. Their conception of instructional games is mostly limited to fun activities and "busy work."

Attitudes. The trainees' general attitude toward designing instructional games is positive, although they are somewhat skeptical as to the games' uses. Most of them believe that a game could be designed very easily, and the amount of time required for the design, tryout, and modification of a game will increase their skepticism.

These trainees do not like a textbook-lecture approach. They will respond positively to a self-instructional media package.

Language. Specialized instructional-design and game-design terminology is not part of the trainees' vocabularies. They can, however, handle fairly sophisticated terminology about handicapped children and special education. Trainee preference is for a conversational, rather than a "textbookish," style.

Tool skills. Trainees do not have any major handicapping conditions. They will be able to handle media equipment with some instructions.

Selected studies on the characteristics and attitudes of special education teachers and teacher trainees

Badt, M. Attitudes of university students toward exceptional children. *Exceptional Children*, 1957, **23**, 286-90.

Compared college education majors with nonmajors. Found negative attitudes prevailed in both groups. Reactions to speech, hearing, and visual handicaps were more positive than to intellectual and emotional disabilities.

Bullock, L. M., & Whelan, R. J. Competencies needed by teachers of emotionally disturbed and socially maladjusted: A comparison. *Exceptional Children*, March 1971, **37**, 485-489.

A comparison between teacher responses in the Mackie (1959) study with a group of similar teachers in 1970. Significant changes reported in teacher perceptions about competencies required and ratings of own proficiencies.

Gottfried, N. W., & Jones, R. L. Career choice factors in special education. *Exceptional Children, 1964*, **30**, 218-23.

Studied factors influencing choice of a career in special education. The most frequent reasons stated for entering the field were previous contact with the handicapped, desire to help others, and the challenge of the work.

Jones, R. L. Teacher education: Preferences for teaching intellectually exceptional children. *Education and Training of the Mentally Retarded*, February 1971, **6**, 43-48.

Teacher trainees and practicing teachers were studied to determine how grade teaching preferences were related to preferences for teaching exceptional children.

Jones, R. L., & Gottfried, N. W. Psychological needs and preferences for teaching exceptional children. *Exceptional Children*, 1966, **32**, 313-321.

Used *Edwards Personal Preference Schedule* and *Teacher Preference Schedule*. Identified a number of personal variables related to preferences for teaching certain exceptionalities.

Mackie, R. P., & Dunn, L. M. *Teachers of children who are blind*. Office of Education, HEW, Washington, D. C., 1955.

Study is part of a nationwide survey on the qualifications and preparation of teachers of exceptional children. Reports on the distinctive competencies and experiences needed by teachers of blind children.

Mackie, R. P., Williams, H. W., & Dunn, L. M. *Teachers of children who are mentally retarded*. U. S. Department A.E.W. Office of Education, HEW, Washington, D. C., GPO Bulletin No. 11, 1957.

Part of series on teachers of exceptional children, based on nationwide survey of preparation and qualification of teachers of exceptional children.

Mackie, R. P., Kvaraceus, W., & Williams, H. *Teachers of children who are socially and emotionally handicapped*. Office of Education, HEW, Washington, D. C., 1957.

Survey of teachers in the area of emotionally and socially disturbed children as to competencies required and ratings of own proficiency.

Mackie, R. P., et al. *Teachers of crippled children and teachers of children with special health problems*. Office of Education, HEW, Washington, D. C., 1961

Survey of teachers in areas of crippled and special health problem children. Includes teacher self-appraisal, special abilities, and experience needed.

Meisgeier, C. The identification of successful teachers of mentally or physically handicapped children. *Exceptional Children*, 1965, **32**, 229-235.

Investigated five dimensions of human behavior. Found three characteristic patterns of successful student teachers: (a) they were well-adjusted, emotionally stable, (b) possessed physical energy, vitality, and enthusiasm, (c) obtained high scores on measures of scholastic achievement ability.

Rudloff, Joseph S. Descriptive profile of teachers of exceptional and non-exceptional children with implications for recruitment. *Journal of Educational Research*, November 1969, **63**, 130-135.

Examination of personality profiles of teachers of hard of hearing and regular classroom teachers.

Semmel, M. I. Teacher attitudes and information pertaining to mental deficiency. *American Journal of Mental Deficiency*, 1959, **53**, 566-74.

Investigated the relationship between the amount of information teachers have about mental deficiency and their attitudes toward mental deficiency. Found special education teachers had more knowledge of mental deficiency than elementary teachers but did not differ significantly on attitudes.

Semmel, M. I., & Dickson, S. Connotative reactions of college students to disability labels. *Exceptional Children*, **32**, 1966, 443-450.

Investigated reactions of elementary and special education majors to various disability labels. Found significant differences toward different disabilities, and differences as a function of various social-psychological situations. Special education majors had higher mean attitude scores compared to elementary education majors. No significance between mean attitude scores for freshmen and seniors of either group.

Semmel, M. I., et al. An exploratory study of the relationship between the training, experience, and selected personality characteristics of teachers and the progress of trainable mentally retarded children. Final report, Wayne County Intermediate School District, Detroit, Michigan, June 1969. 665 pp.

A study of the relationship between certain teacher characteristics and TMR pupil growth. Examined teacher characteristics, attitudes, and preference for teaching various types of children and grade levels.

Willman, C. E. A comparison of prospective special education and elementary teachers on selected personality characteristics. (Doctoral dissertation, University of Michigan) Ann Arbor, Michigan, University Microfilms, 1966. No. 67-8367.

Investigated differences between special education and elementary teachers on the *Edwards Personal Preference Schedule*, MTAI, the *Study of Values*, and biographical data. Found small differences among special education majors in the various areas of exceptionality, but significant differences in basic needs, attitudes, and interest between prospective elementary and prospective special education teachers.

Chapter 4
Task analysis

Objectives

1. Describe the task analysis procedure and relate it to other steps in instructional development.
2. Given a statement describing an instructional task, perform a task analysis and list various subtasks in a hierarchy.
3. Evaluate and revise the outcomes of task analysis so that they are complete and include no irrelevant, trivial, unnecessary, or redundant subtasks.

Task analysis is a preliminary step in instructional development. It is the means by which the instructional task is broken down into various component subtasks.

Why task analysis?

Task analysis forms the basis for both the construction of measuring instruments and the design of instructional materials. The type of instructional task, as determined by this analysis, helps to determine the media to be used. For example, a basically nonverbal task such as visual prompting lends itself to the use of film or video tape, while a verbal task such as questioning may be taught primarily through audio tape. The type of task also suggests the instructional format: A complex interrelated set of tasks will lend itself to the use of a simulation game. The sequence of subtasks suggests the sequence of instruction. In the editing stage of instructional development, a subject-matter specialist need go through only the task analysis (rather than the entire package) to check the adequacy of coverage and the suitability of sequence. Finally, in the dissemination stage, the task analysis enables a potential user to get a quick overview of the content of the package.

How to perform a task analysis

Basically, task analysis involves the study of a master performer's behavior and the identification of its components. In the case of a psychomotor performance (e.g., how to fix a hearing aid), task analysis

may involve primarily the observation of a skilled performer. In addition, the instructional developer may also try his hand at performing the task—doing his analysis while learning the task. With cognitive skills (e.g., how to write teacher-made reading materials), the analysis depends more upon interviews with subject-matter experts than upon observation. In addition, textual materials, test items, curricular guides, and other references can be used to add greater depth and generality to the analysis. In the case of innovative techniques for teaching, when no expert performers and reference materials are available, a useful technique is to imagine a hypothetical performer and analyze his "behavior."

Because task analysis is a step-by-step process, any of which may require rewriting several times before it is in final form, a chalkboard is a very efficient teaching aid.

Steps in an actual task analysis follow:

1. Specify the main task. This step requires a comprehensive statement of the task's objective. It should indicate the skill the trainee is expected to acquire upon the completion of instruction and the situation in which the skill will be used. On the top center of the board, a main task may be stated as follows:

Figure 4.1
Task analysis: step 1

2. Identify subtasks at the preceding level of complexity. This step is accomplished by asking, "What skills should the trainee possess in order to perform the main task?" Obviously hundreds of skills contribute to any performance but, at this stage, we are interested only in identifying those that immediately contribute to our main task. The sample main task (Fig. 4.1) logically breaks up into the subtasks of administering the test and interpreting its results. As shown in Figure 4.2, these two subtasks are placed below the main task and lines are drawn to indicate their relation to the main task.

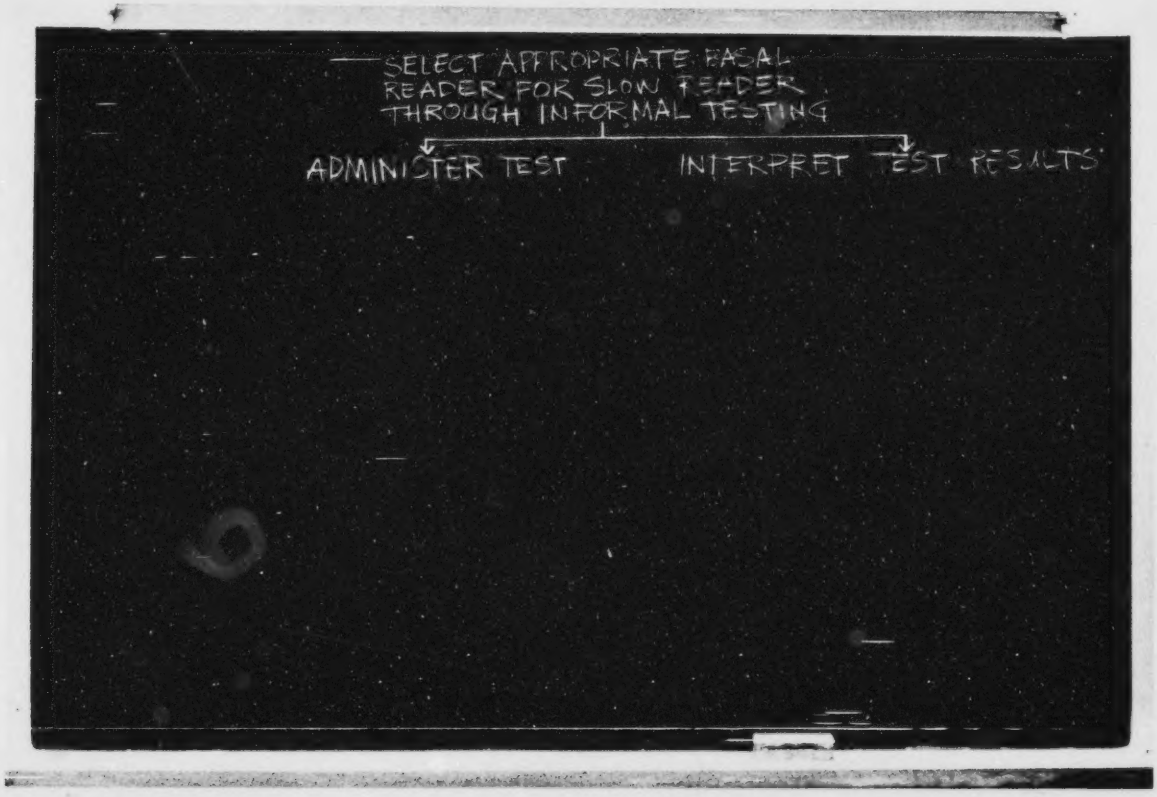


Figure 4.2
Task analysis: step 2

3. Treat each subtask as a main task and repeat the analytic procedure. We took each of the two subtasks in our illustration (administering test and interpreting test results) and identified the tasks at the preceding level of complexity which are necessary for its performance. Thus the task of administering the test broke down into the four elementary subtasks of (a) choosing a suitable book, (b) choosing passages for reading from this book, (c) having the child read the passages, and (d) counting the number of errors he makes. The chalkboard would now look like this:

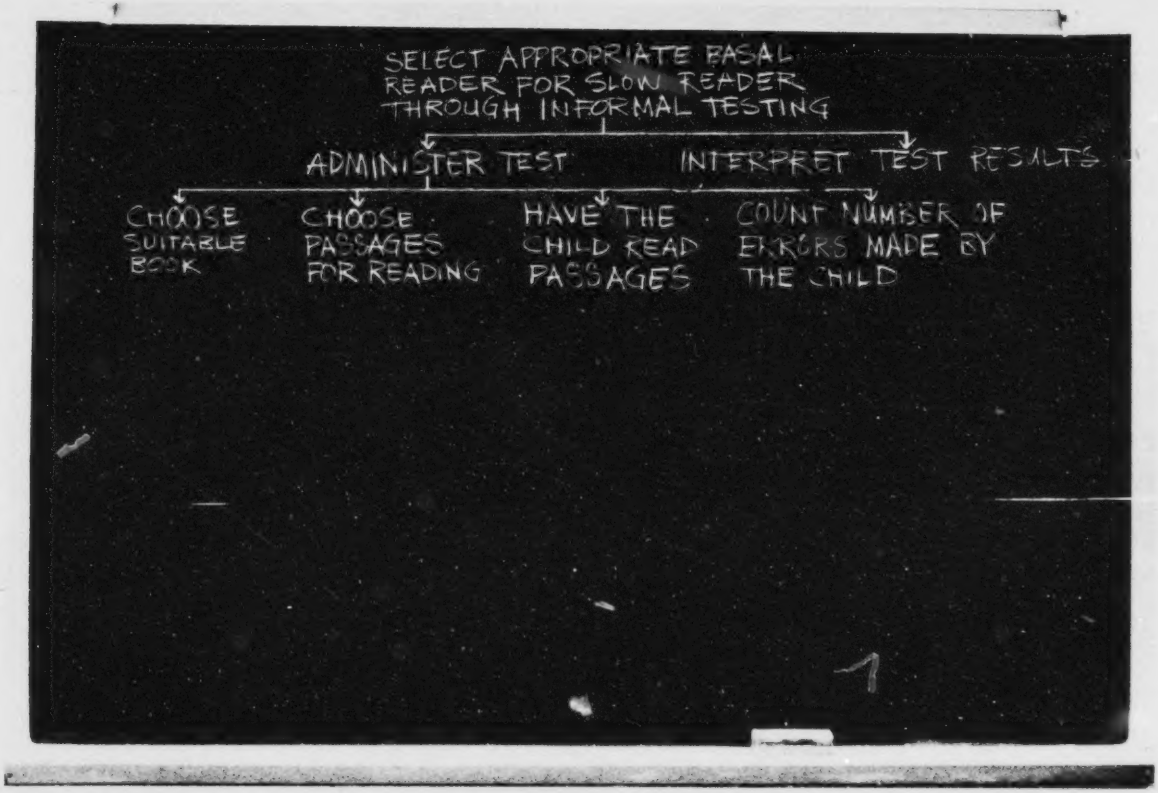

SELECT APPROPRIATE BASAL READER FOR SLOW READER THROUGH INFORMAL TESTING
ADMINISTER TEST
INTERPRET TEST RESULTS
CHOOSE SUITABLE BOOK
CHOOSE PASSAGES FOR READING
HAVE THE CHILD READ PASSAGES
COUNT NUMBER OF ERRORS MADE BY THE CHILD

Figure 4.3
Task analysis: step 3

4. Terminate analysis when subtask reaches the entry level of the teacher trainees. Analysis of the task can be halted at a logical point. In our illustration (Fig. 4.4), at the third level, the task broke down into two subtasks: finding the highest grade level from the child's records and choosing a basal reader. We stopped the analysis here as both skills were within the trainee's entry level (determined by an earlier instructional module on selection of books at different grade levels and identification of reading errors). Had we carried the analysis down, we would have had to include counting off 100 words and deciding if a number is greater than five, skills obviously within a trainee's repertoire.

The completed task analysis is shown in Figure 4.5. The value of a chalkboard should now be obvious.

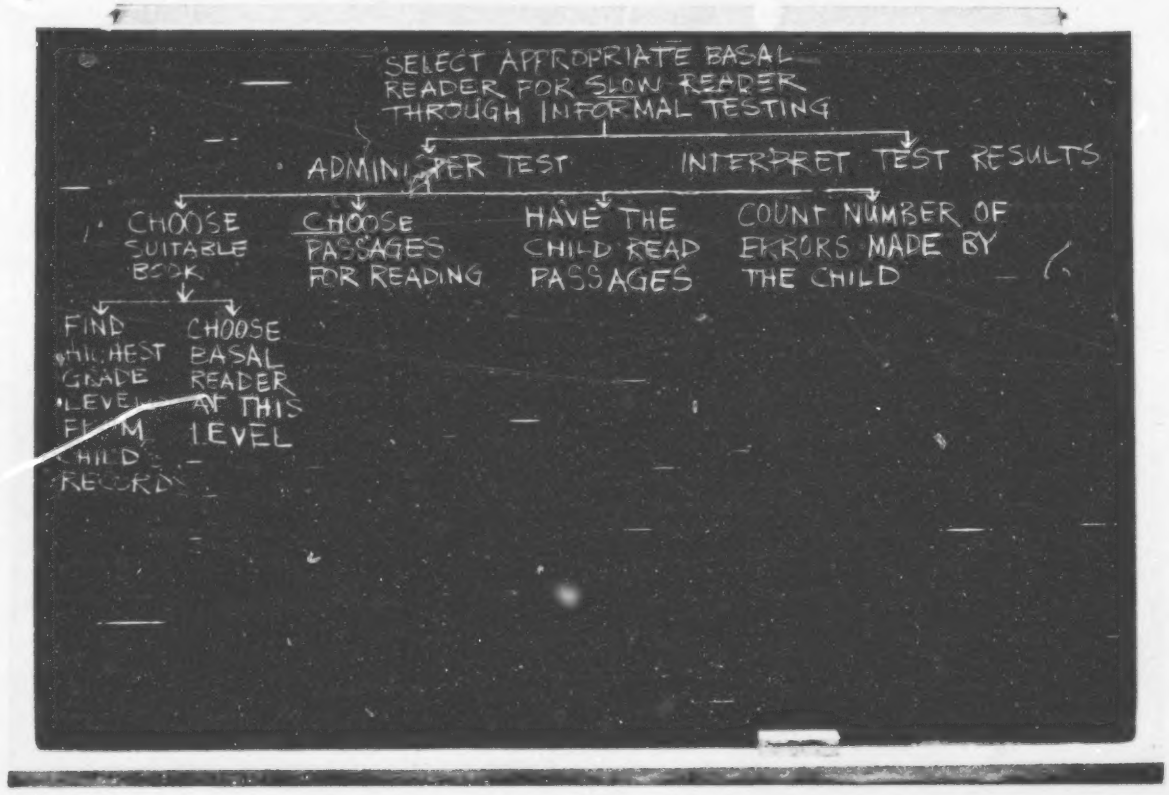

SELECT APPROPRIATE BASAL READER FOR SLOW READER THROUGH INFORMAL TESTING
ADMINISTER TEST
INTERPRET TEST RESULTS
CHOOSE SUITABLE BOOK
CHOOSE PASSAGES FOR READING
HAVE THE CHILD READ PASSAGES
COUNT NUMBER OF ERRORS MADE BY THE CHILD
FIND HIGHEST GRADE LEVEL FROM CHILD'S RECORDS
CHOOSE BASAL READER AT THIS LEVEL

Figure 4.4
Task analysis: step 4

Completing the task analysis. When the analysis is complete, prepare a list of all major and minor tasks and carefully review it to make sure that sufficient and necessary subtasks have been included. Checklist 4.1 should be useful for this purpose. In addition to using the checklist, it is a good idea for the analyst to get opinions of the analysis from colleagues. They too may use the checklist or they may classify the task analysis items in terms of "irrelevant," "relevant-but-trivial," and "essential" categories.

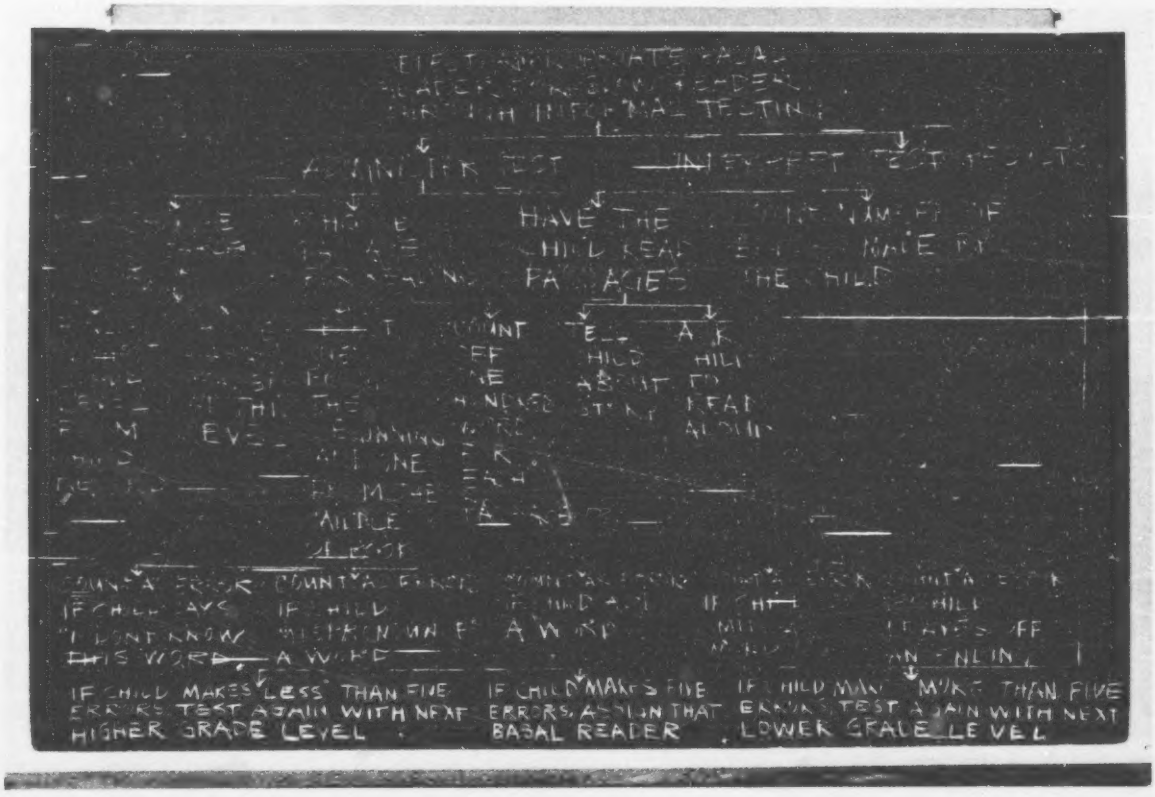

IF CHILD MAKES LESS THAN FIVE ERRORS TEST AGAIN WITH NEXT HIGHER GRADE LEVEL
IF CHILD MAKES FIVE ERRORS, ASSIGN THAT BASAL READER
IF CHILD MAKES MORE THAN FIVE ERRORS TEST AGAIN WITH NEXT LOWER GRADE LEVEL

Figure 4.5
Task analysis: step 5

Additional examples of task analysis. The following illustrations are taken from actual instructional materials for training teachers of exceptional children. Note that each analysis begins with the terminal performance and works backward through different levels of prerequisite skills. All task analyses are terminated at the entry level of the target trainees. Some divergence among entry levels can be seen because each analyst worked with his specific target trainees.

Figure 4.6 shows a fairly simple analysis of a psychomotor skill. It is part of an instructional package on the use of cameras in deaf education classrooms to enhance the children's visual literacy (Stallings, 1972). This analysis was made by observing photographers' performances and by examining instructional manuals (on camera usage).

The next analysis deals with the tasks of developing instructional materials for parents to use with their handicapped children and training parents to use the materials. The analysis is based on a series of journal articles and class handouts written by different special education instructors. The contents of the materials were analyzed and the subtasks were

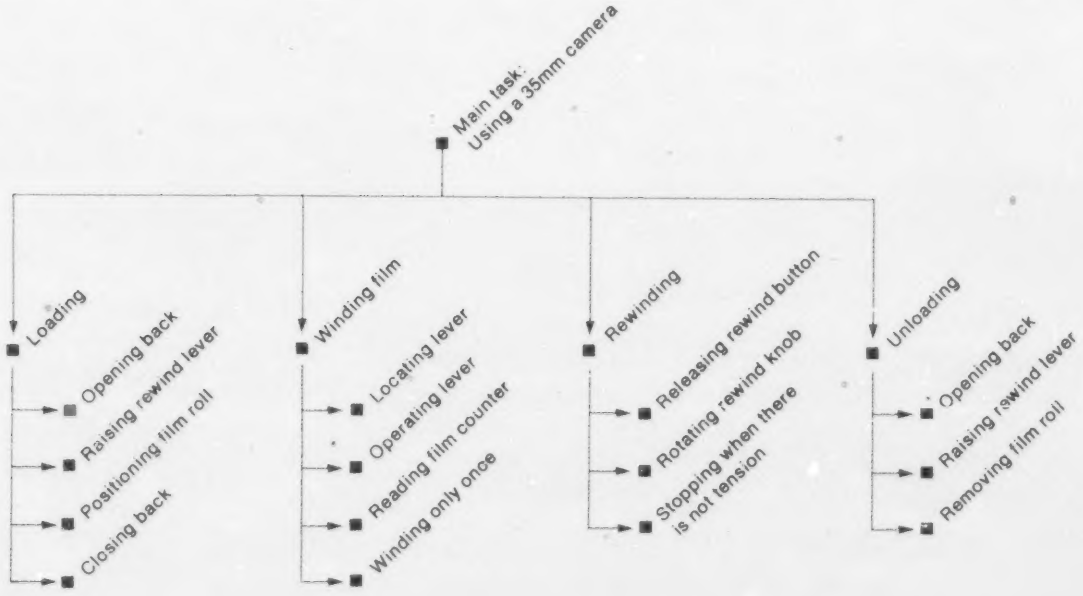


Figure 4.6
Analysis of *using a camera*

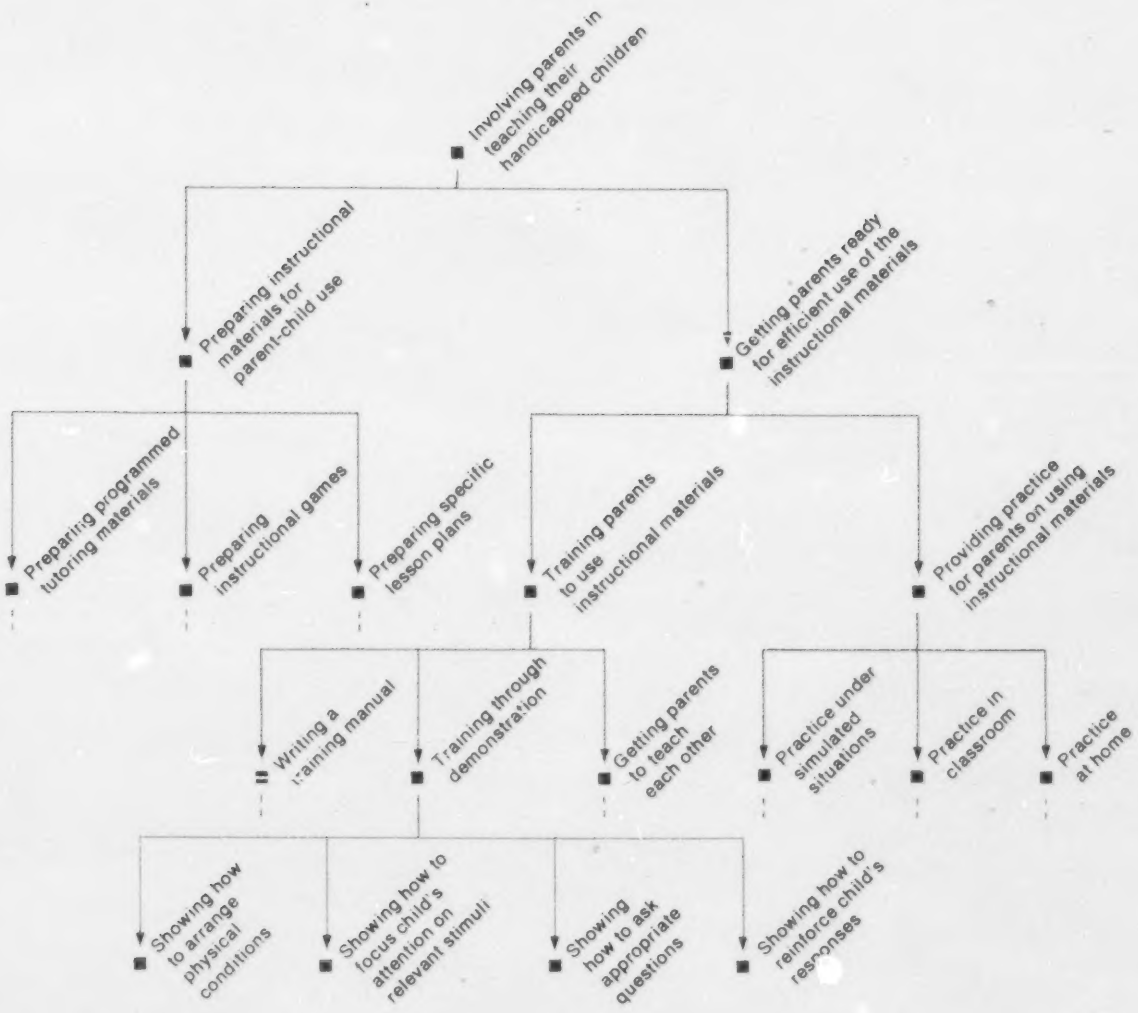

Involving parents in teaching their handicapped children
Preparing instructional materials for parent-child use
Getting parents ready for efficient use of the instructional materials
Preparing programmed tutoring materials
Preparing instructional games
Preparing specific lesson plans
Training parents to use instructional materials
Providing practice for parents on using instructional materials
Writing a training manual
Training through demonstration
Getting parents to teach each other
Practice under simulated situations
Practice in classroom
Practice at home
Showing how to arrange physical conditions
Showing how to focus child's attention on relevant stimuli
Showing how to ask appropriate questions
Showing how to reinforce child's responses

Figure 4.7
Analysis of task of *teaching handicapped children through parents*.

derived from them. Figure 4.7 shows only part of the analysis; all tasks shown in the boxes with an open line need further analysis into more elementary subtasks.

The main task for the special education teacher in Figure 4.7 is involving parents in the teaching of their handicapped children. The task requires that the teacher prepare instructional materials that need little or no instructional decision-making by parents. Three basic types of such materials are identified in the analysis: programed tutoring materials, instructional games, and specific lesson plans. The preparation of each involves a number of subtasks which are not shown. Another aspect of the parent involvement is to train them to use these instructional materials and to provide them with relevant practice. Such practice involves the subtasks of arranging simulated situations in which the teacher and the parent can play the roles of parents and children, classroom situations in which parents can practice tutoring under the supervision of the teacher, and home situations in which parents function on their own. The training task is analyzed into the three subtasks of writing a parent's manual, demonstrating specific teaching skills, and getting parents to teach each other. Figure 4.7 shows further analysis of only one of the three subtasks, "Training through demonstration." In order to give a demonstration, the teacher must have the skills to show the parents proper seating arrangements and how to point out specific items for the child to observe, ask appropriate questions, and reinforce the child's response. The analysis of this branch is terminated at this level because the learner analysis indicates that the target trainees (experienced special teachers) are able to perform these tasks.

The last sample is an analysis of a more complex task for less sophisticated target trainees (Fig. 4.8). The task is the use of an observation coding system in a classroom for emotionally disturbed children. This particular system (Fink & Semmel, 1971) is concerned with deviant classroom behaviors manifested by children and the control techniques used by teachers. The target trainees were a heterogeneous group of substitute teachers and aides who had been hired as coders for a research project. Since even the originators of the system could not code all relevant behaviors with absolute reliability over a long period of time, the analysis was based on the performance of a hypothetical perfect coder.

The task required of this ideal coder was to observe a classroom and record, once every five seconds, the occurrence of relevant categories of behaviors (e.g., student physical aggression and teacher control through punishment). The task was analyzed into the subtasks of the ability to discriminate between different categories of behavior (e.g., between verbal and physical hostility) according to the system, working under external pacing (i.e., recording every five seconds), tolerating noisy distractions in the classroom which did not come under the domain of the system, working without any feedback on the accuracy of coding, and efficiently using a special machine-readable recording sheet. Figure 4.8 shows the further analysis of the last of these subtasks into the more elementary subtasks of locating boxes and coloring bubbles on the coding sheets.

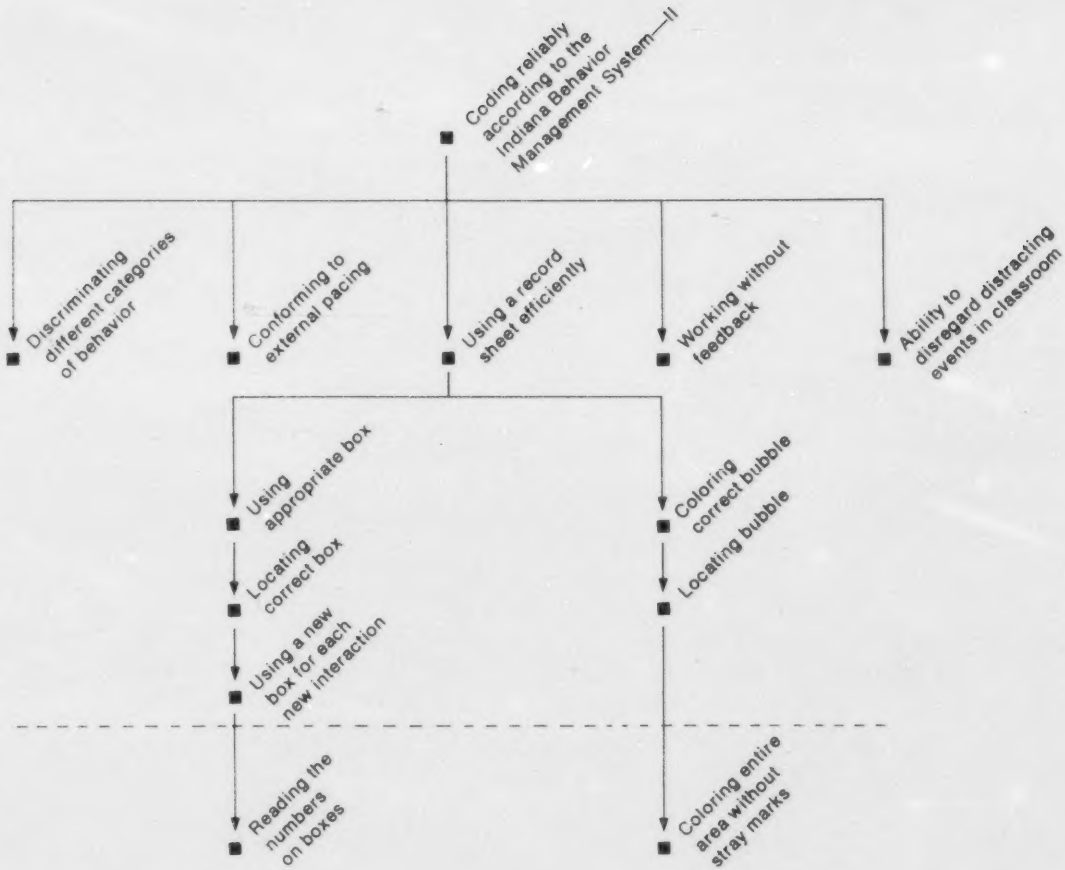

Coding reliably according to the Indiana Behavior Management System—II
Discriminating different categories of behavior
Conforming to external pacing
Using a record sheet efficiently
Working without feedback
Ability to disregard distracting events in classroom
Using appropriate box
Locating correct box
Using a new box for each new interaction
Coloring correct bubble
Locating bubble
Reading the numbers on boxes
Coloring entire area without stray marks

Figure 4.8
Analysis of the task of *coding reliably*.

Checklist 4.1
Analyzing teacher tasks in special education

Relevance. Is the main task relevant to the effective performance of a teacher in a real-world classroom with handicapped children?

Completeness. Are enough subtasks listed to cover the performance of the main task? Has any essential subtask been omitted?

Triviality. Is any subtask included which is simpler than the entry level of the target trainees?

Necessity. Is each subtask necessary for the performance of the main task? Are any of the subtasks unnecessary?

Redundancy. Is any subtask repeated more than once with or without minor changes in wording? Is any set of subtasks an alternate for the performances contained in another set of subtasks?

The first item in the checklist is included so that the trainer will seek other opinions. Familiarity with a task may lead one to take certain skills for granted and omit them. For example, in the design of a training module on grouping EMR children for instruction, we assumed that all teacher trainees knew how to estimate the mental age of a child, given IQ and chronological age. It turned out to be a poor assumption; the trainees had to be taught (or retaught) the procedure. One way to check the completeness of task analysis is to train a naive student on the listed subtasks and see if he can synthesize the main task.

Inclusion of trivial tasks is an error at the other extreme. A trivial task is one below the entry behavior of the trainees. In the same module on grouping EMR children, we included a segment on computing the mean of two scores. Such a task, though essential, was already in the trainees' repertoires; they required only to be told when to do it, not how to do it.

The trainer is frequently tempted to list unnecessary tasks merely because of tradition. All tasks somehow seem relevant to all other tasks and it is very difficult to be objective. In our module on grouping EMR children, although we did not include such obviously unnecessary items as knowledge of a history of grouping in classrooms, a few questionable items escaped detection. The major problem with irrelevant tasks is that they are readily detected by trainees and may evoke student negativism.

A comprehensive task analysis takes up considerably more time than dashing off an outline. A quick task analysis may appear to save time but it can result in an inadequate design that will necessitate expensive modifications in later stages.

Chapter 5
Concept analysis

Objectives

1. Briefly describe the process of concept analysis and relate it to other steps in the instructional development process.
2. Given a set of related concepts, arrange them in a concept hierarchy.
3. Given a concept, analyze it into critical and irrelevant attributes and specify different types of examples and nonexamples to be used for instruction and testing.

The technique of concept analysis is similar to that of task analysis except for the content to which it is applied. Task analysis is used when skill development is the goal of instruction. Concept analysis is used when the acquisition of knowledge is the goal. Since the basic framework of acquiring knowledge is conceptual, the use of task analysis for such knowledge would result in the identification of trivial tasks like the ability to recite a definition. By using concept analysis, however, the instructional developer can analyze a set of concepts which are pertinent to the teaching of exceptional children, arrange them in hierarchies, and identify the critical and irrelevant attributes of each.

Nature of concepts in the education of exceptional children

Before discussing concept analysis, we will try to clarify the concept of *concept* itself. From an instructional point of view, a concept may be defined as a collection of stimuli (and their relations) which evokes a common response. In more general terms, a concept is a category with a set of criteria for determining what to include or exclude from that category. The characteristics shared by all objects or events in a concept category are termed "critical attributes." They are the essential criteria for membership in that concept category. Characteristics which are shared by some but not all members of the concept category are "irrelevant attributes." Related concepts belong to a "superordinate category" or a "concept hierarchy." The relations of these terms are graphically depicted in Figure 5.1.

The concepts frequently encountered in the education of exceptional children share two major

characteristics: (a) They are usually categories of events rather than objects and they involve behavioral attributes of pupils and teachers, often in interaction with each other. (b) These concepts are systematically created out of analyses of behaviors and interactions of pupils and teachers and unlike the more open-ended ordinary language concepts, they have rigidly defined boundaries.

How to do a concept analysis

Contrary to the implications of Figure 5.1, concept analysis seldom progresses deductively from the superordinate category through individual concepts to subordinate attributes. Rather, it is a back-and-forth movement across various levels. The end product of the analysis may be a chart like Figure 5.1, which lists critical and irrelevant attributes. The starting point is usually a collection of real or imaginary examples and alternative definitions of concept categories.

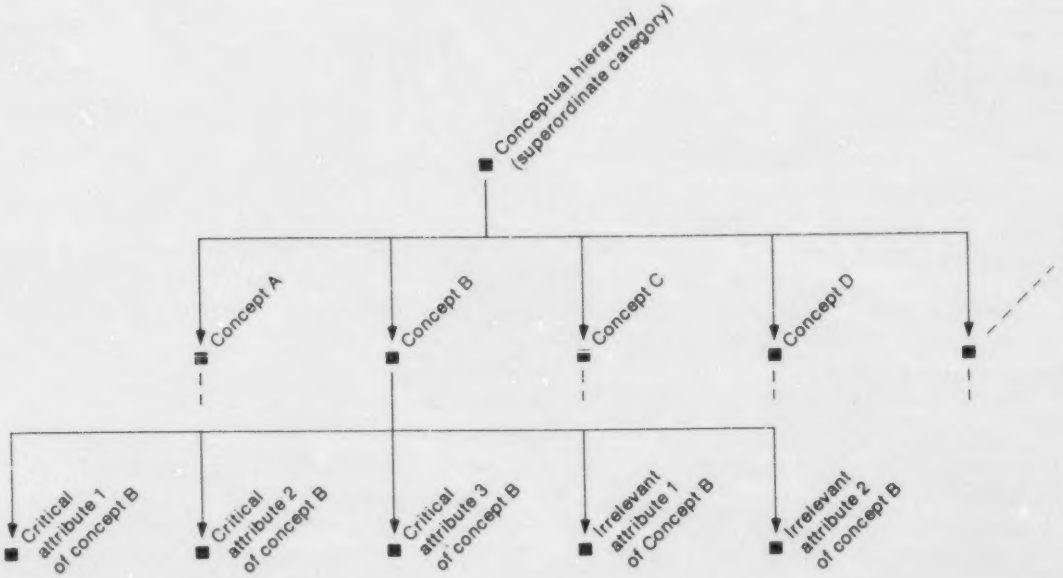

Conceptual hierarchy (superordinate category)
Concept A
Concept B
Concept C
Concept D
Critical attribute 1 of concept B
Critical attribute 2 of concept B
Critical attribute 3 of concept B
Irrelevant attribute 1 of Concept B
Irrelevant attribute 2 of concept B

Figure 5.1
Relationship between conceptual hierarchy concepts, and attributes.

A good beginning may be made with clear-cut positive examples which permit us to say, "Well, if *that* isn't an example of so-and-so, then nothing is" (Wilson, 1963, p. 28). Taking the concept of physical aggression as a sample, a strong positive example is the case of an emotionally disturbed child hitting another child in the classroom. By comparing and contrasting this example with others, such as those of a "normal" girl biting her teacher, a boy kicking his neighbor, and other children hitting, throwing things, and spitting, we come up with shared and variable attributes which enable us to identify physical aggression. To find out what physical aggression is not, we analyze nonexamples (behaviors that make us say, "Well, whatever so-and-so is, it certainly is not an instance" [Wilson, 1963, p. 29]). Two children walking arm in arm is definitely a nonexample of physical aggression.

Once we have identified the major attributes of the concept and classified them as critical or irrelevant, we are ready for some finer discriminations based upon the analysis of borderline examples and close-in nonexamples. In the case of physical aggression, how do we classify one child's hitting another at the teacher's direction (i.e., a boxing lesson in physical education)? If a child hurts himself, is that physical aggression? If a child throws a stone through a glass window? Or makes a verbal threat to kill the teacher (but does not carry it out)? If a child shoves the person in front of him in the line because everyone behind him is shoving? If a child accidentally trips another child? If the teacher physically evicts a child from a seat that does not belong to him? What if a child performs the same act? What if a boy hits back after being attacked by another child?

Through grappling with such borderline cases we clarify the concept and come up with a tighter set of critical and irrelevant attributes as well as with suggestions for new categories in which nonexamples of the original concept become examples. The end result of this stage of analysis is the specification of a set of critical and irrelevant attributes. The following list adapted from the Indiana Behavior Management System (Fink & Semmel, 1971), gives the critical and irrelevant attributes of the concept of physical aggression, insofar as a teacher is concerned.

Concept of physical aggression

Critical attributes:
1. An act of a pupil.
2. Pupil is *not* working on the task assigned by the teacher.
3. Pupil interacts with some other person.
4. His interaction is physical.
5. The physical interaction is intentionally unfriendly.

Irrelevant attributes:
1. The target of physical aggression can be another person—a pupil, teacher, or someone else, or more than one person, as in the case of a single child fighting the entire class.
2. Aggression may take a wide variety of forms, such as hitting, kicking, spitting, throwing things, and pushing.
3. Physical aggression may or may not be accompanied by verbal aggression (insulting, abusing, and swearing).
4. Physical aggression as retaliation is classified the same as an initiatory aggression.
5. Physical aggression need not always take place in the classroom.

The attributes list prescribes the nature of the examples and nonexamples to be used in teaching the concept and testing the teacher trainee's mastery of it. The list also assists in the generation of an adequate definition of the concept.

Usually, a set of related concepts is analyzed in a parallel fashion. After the attributes of each concept have been identified, they are compared across categories to locate clusters of concepts. The outcome of such a comparison is a concept hierarchy which is very similar to the outcome of a task analysis. Figure

5.2 shows a sample hierarchy of a set of concepts related to deviant pupil behavior. The general area of interest, pupil behavior, is dichotomized into on-task and off-task behavior. Off-task behavior is subdivided into two major categories, the pupil acting alone or interacting with someone. Individual behavior is next divided into silent (e.g., daydreaming) and noisy (e.g., whistling) categories, which are labeled self-involvement and noise, respectively. Interactive behavior is divided into physical and verbal categories; each in turn can be friendly (e.g., touching or whispering to someone else), aggressive (e.g., punching someone else or shouting insults at the teacher), or resistive (e.g., pulling away from the teacher or verbally refusing to carry out teacher directions). The following definitions of the various concept categories in this framework are based on Fink and Semmel (1971).

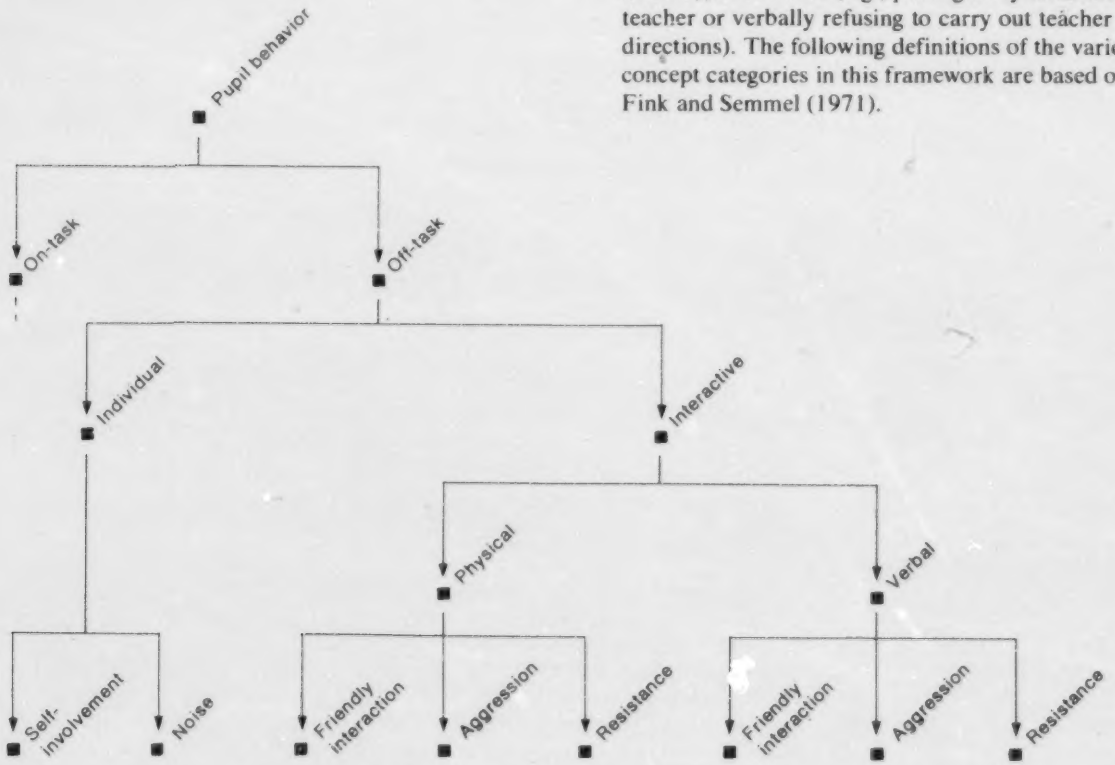


Figure 5.2
Hierarchy of a set of concepts related to pupil behavior, based on Fink and Semmel (1971).

On-task:
Pupil attending to teacher or to other persons or objects related to the lesson as defined by the teacher.

Self-involvement:
Pupil is "alone" and quiet. No verbal or physical interaction with others, that is, staring, daydreaming, playing with self or other objects, muttering to self, wandering around alone or sleeping.

Noise:
Verbal and physical behavior is noncommunicative and disruptive, such as slamming a desk, tapping feet, whistling, or clapping hands, and not an integral part of task.

Physical interaction:
Friendly interactions are not aggressive, as for example, playing a game, touching someone, etc.

Physical aggression:
Physical attack, such as punching, hitting, spitting, throwing something at someone, etc., is directed against peers or teacher.

Physical resistance:
Physical refusal to cooperate with teacher directions, such as sitting still and continuing to misbehave or using physical force to resist teacher.

Verbal interaction:
Talking when not supposed to in a nonaggressive fashion.

Verbal aggression:
Insulting, abusive, angry statements directed toward peers or teacher.

Verbal resistance:
Verbal refusal to carry out teacher directions (either to do a particular task or to stop misbehaving).

Graphic charts, such as Figure 5.2 and, more importantly, the process of arriving at them, help in a number of ways. In addition to providing a framework for a set of related concepts, they facilitate the location of gaps in the concept hierarchy. Later, during the design of instructional materials, the various levels of concepts suggest diverse sequencing strategies. Examples of a concept may be used also as effective nonexamples for another concept at the same level. Since the concepts at each level share a number of attributes and differ only in critical attributes, they require the teacher trainee to make fine discriminations.

Additional examples

There follow some additional examples of concept analysis from the area of behavior management techniques used by teachers. Figure 5.3 presents a hierarchy of concepts related to teacher control techniques followed by brief definitions of the concepts. An analysis of one of these concepts—empathic control—into critical and irrelevant attributes is also presented.

Definitions of a set of concepts related to teacher control techniques, based on Fink and Semmel (1971).

Instruction:
Any teacher behavior related to the lesson. In general, it includes all teacher behavior which has not been initiated by pupil disruptive behavior.

Threat:
Verbal statements specifying or implying that negative consequences or punishment will follow the misbehavior of the pupil.

Incentive:
Verbal statement specifying or implying that positive consequences or rewards will follow the cessation of misbehavior by the pupil.

Empathic control:
Teacher expression of understanding the pupil's feelings and behavior.

Probe:
Teacher questioning to find out (or get the pupil to think about) the reason for misbehavior.

Humor:
Teacher attempts to reduce tension and control pupil behavior by means of jokes, clowning, asides, or other such activities without intent to criticize the pupil.

Authority demand:
Direct verbal commands to cease and desist in firm, authoritative tone.

Signal demand:
A conditioned-stimulus signal (e.g., calling the pupil's name, "Shhh," pause, or staring) requiring the pupil to stop misbehaving.

Value-law demand:
Teacher explicitly reminding pupil of the established rules of behavior in the classroom by describing or referring to the behavior norm.

Criticizing:
Psychological degradation of pupils through verbal attack, criticism, or sarcasm.

Critical and irrelevant attributes of the concept of empathic control, based on Fink and Semmel (1971).

Critical attributes of empathic control.
1. An act of teacher.
2. Initiated by pupil misbehavior.
3. Misbehavior is not criticized.
4. Expressions of understanding pupil's feelings.
5. Relating pupil's behavior to his feelings.

Irrelevant attributes of empathic control.
1. Empathic control can be initiated by any type of pupil misbehavior.
2. Statements may be made to an individual pupil or to a group of pupils.
3. Statements may or may not be accompanied by reassuring physical contact.
4. Language of the empathic statements may vary considerably.

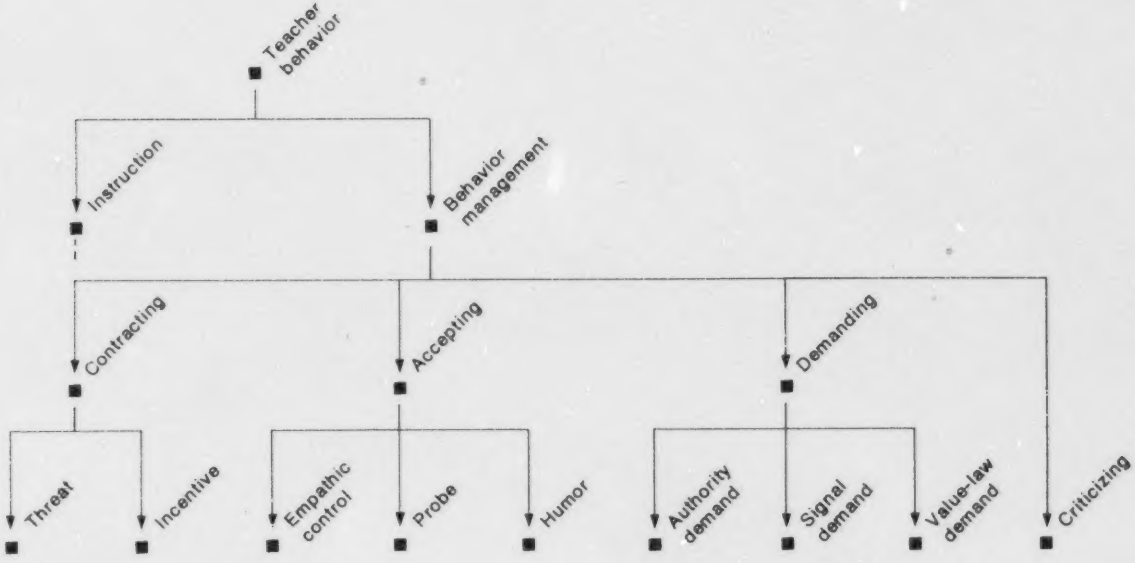


Figure 5.3
Hierarchy of concepts related to teacher behavior, based on Fink and Semmel (1971).

Chapter 6
Specifying instructional objectives

Objectives

1. Define a behavioral objective in terms of its components, and give a rationale for use of behavioral objectives in instructional development.
2. Convert the outcomes of a task analysis into a set of behavioral objectives.
3. Convert the outcomes of concept analysis into behavioral objectives.

The specification of instructional objectives is the transformation of task and concept analyses into statements of goals for instructional material. Although the debate continues on the "best" type of objectives, there is general consensus that the most useful behavioral objectives for instructional development and evaluation are those that specify the desired terminal behavior of the trainee.

Why specify objectives?

Objectives form the basis for both the design and evaluation of instructional materials. In sequence, they provide an outline of the material. Developmental time and resource allotments may be made according to the number of objectives and the relative complexity of each. The nature of the objectives is also one of the most important factors in the selection of instructional media and format. In the actual design of the material, objectives provide corroboration of the relevance of instructional content and activities.

A set of objectives arranged in a suitable sequence becomes the most important component of the instructional package. In one instructional format, the teacher trainee is merely provided with such a set of objectives and entrusted with the responsibility of attaining them. In another effective format, objectives are keyed to a variety of existing textbooks, articles, and other alternative resources. Objectives form the basis for the construction of a criterion test which, in turn, provides for quality control during development of the instructional materials. Objectives are also useful during the dissemination of instructional materials. By scanning them, a potential user can decide whether or how much they coincide with his

goals. During actual use of the materials, objectives serve as self-evaluation checklists to facilitate the teacher trainee's learning. Geis (1972) pointed out another very beneficial but often overlooked effect of objectives on the person who specifies them. The process of specification produces new insights and attitudes (including increased humility about goals), refocus of attention on the learner, re-examination of the contribution of instruction, and clarification of the relation between instructional objectives and societal requirements.

How to convert task analysis into behavioral objectives

Objectives are not created haphazardly; they are derived from an analysis of the instructional task or concept. When the task analysis and/or concept analysis is completed, the process of specifying objectives may be viewed as an attempt to communicate unambiguously the instructional intent of the material to its potential users. "How-to" books on writing behavioral objectives are given in the bibliography at the end of this chapter. The following five-step process (Thiagarajan, 1971) uses three examples based on the task analyses presented in Chapter 4 to show how behavioral objectives can be derived systematically.

Step 1. Specify teacher trainee's terminal behavior or the results he is to produce.

Statements of objectives in terms of content (e.g., "parental involvement") or what the instructional material does (e.g., "This module teaches you how to select a suitable reader for an educable mentally retarded pupil") do not convey expected instructional outcomes. The most essential component of a behavioral objective is the specification of the terminal behavior which is expected of the teacher trainee as a result of the instruction. Here are some examples of objectives in which the behavioral terms are emphasized.

> The teacher trainee shall *load* a camera. . . .
>
> The teacher trainee shall *administer* an informal textbook test to an educable mentally retarded (EMR) child. . . .
>
> The teacher trainee shall *write* a specific lesson plan for use by parents. . . .

In the last objective, we are obviously not interested in the actual behavior of writing (i.e., the process of holding a pen and forming letters and words) but in the outcome of the writing. In this sense, the term "behavioral objectives" is misleading because we may be interested in either the behavior or its outcome.

Step 2. Indicate the range of situations under which the teacher trainee is expected to perform.

Although the objectives are now fairly specific, we do not know the range of the expected performance. In the first example, is the learner to load an instamatic camera, a movie camera, or some other type of camera? By including a statement on the kind of camera—the range for the expected performance—the objective is made specific. Look at the third example: Is the teacher trainee expected to come up with lesson plans on any topic or only on topics of his choice? Again, the statement about the range for the expected performance makes the objectives more specific.

The teacher trainee shall load *any standard 35mm camera*. . . .

The teacher trainee shall administer *an informal textbook* test to an EMR child. . . .

The teacher trainee shall write a specific lesson plan *on a topic of his choice* for use by parents. . . .

Step 3. Specify reference materials, aids, and equipment which the teacher trainee may or may not use.

When the teacher trainee loads the camera, can he use the instruction manual which came with the camera? Can he refer to a checklist while administering the informal textbook test? Can he use curriculum guides and textbooks while preparing his lesson plan? Answers to these questions make the objectives more specific.

The teacher trainee shall load a . . . camera *without any references*.

The teacher trainee shall administer the informal textbook test . . . *without the use of any procedural guidelines*.

The teacher trainee shall write a specific lesson plan. . . . *He will have free access to curriculum materials and guides*.

Step 4. Indicate the standards for acceptable performance by the teacher trainee and for his products.

Do we want the camera to be ready for shooting pictures? What procedures should the trainee follow during the administration of the test? How detailed should lesson plans be? The answers to these questions provide the standards for our objectives.

. . . When loaded, the film should be properly advanced to the first frame and the camera ready for use.

. . . In administering the test, the teacher trainee should follow this procedure:

1. Find the highest grade level from the child's records.
2. Choose basal reader at this level.
3. Choose two 100-word passages for reading.
4. Introduce the story to the child.
5. Ask child to read aloud.
6. Count number of errors made by the child.

. . . The final version of the lesson plan should contain (a) a set of objectives for the child to attain, (b) a set of questions to be asked by the parent, (c) a list of equipment needed, (d) a list of words to be emphasized, and (e) a suggested schedule of activities.

Step 5. Specify a time limit within which the teacher trainee is to perform or complete his product.

Here are some sample time limits:

The teacher trainee shall load the camera . . . *within two minutes*.

The teacher trainee shall administer an informal textbook test . . . *within a period of 30 minutes*.

The teacher trainee shall write a lesson plan . . . *within a week's time*.

In summary, the essential components of behavioral objectives are the specification of

. . . a performance or product.
. . . the performance range.
. . . the performance conditions.
. . . standards for the performance or product.
. . . time limits, if appropriate.

Here are the completed statements of our three illustrative objectives:

> The teacher trainee shall load any standard 35mm camera with a standard roll of film within two minutes, without using any references. When loaded, the film should be properly advanced to the first frame and the camera ready for use.

> The teacher trainee shall administer an informal textbook test to an EMR child, without using any procedural guidelines and within a period of 30 minutes. He will be provided with the child's records and a variety of readers. In administering the test, the teacher trainee should follow this procedure:
>
> 1. Find the highest grade level from the child's records.
> 2. Choose basal reader at this level.
> 3. Choose two 100-word passages for reading.
> 4. Introduce the story to the child.
> 5. Ask child to read aloud.
> 6. Count number of errors made by the child.

> Using any curriculum materials and guides, the teacher trainee shall prepare a specific lesson plan for use by parents in helping their children. The lesson plan may be on any topic. The final version should be produced within a week's time and should contain the following:
>
> 1. A set of objectives.
> 2. A set of questions to be asked by the parent.
> 3. A list of words to be emphasized.
> 4. A list of equipment.
> 5. A suggested schedule of activities.

Beyond trivial objectives

Behavioral objectives very often turn out to be mechanical and trivial because the first set of behavioral terms which come to mind are frequently simplistic (e.g., "label," "list," "state," and "select"). However, other behavioral terms, such as "evaluate," "justify," "redesign," and "compare and contrast," may be identified through a longer search and used appropriately. A number of books and articles (Gronlund, 1970; Metfessel, Michael, & Kirsner, 1969; Vargas, 1972) contain lists of suitable behavioral terms associated with higher-level learning tasks.

An example follows of how to convert an analysis of a concept (Chapter 5) into nontrivial behavioral objectives through the five-step process.

How to convert concept analyses into behavioral objectives

Step 1. Specify teacher trainee's terminal behavior or the products he is to produce.

In the case of conceptual learning, the teacher trainee should be able to perform behaviors which are most often related to the mastery of a concept:

To *define* the concept.

To *label* different examples of the concept.

To *generate* new examples of the concept.

The behavior of labeling different examples (e.g., of student off-task behavior) or generating different examples (e.g., of empathic statements) is more relevant to a teacher trainee than that of reciting verbal definitions. Depending upon the nature of the instructional material, either or both terms can be used in the objective. Here is a sample objective:

> The teacher trainee shall correctly label all given examples of pupil physical aggression. . . .

Step 2. Indicate the range of situations under which the teacher trainee is expected to perform.

If the teacher trainee is supplied only with examples of physical aggression and asked to label them, then we are merely measuring his ability to generalize.

Real understanding of the concept also requires that the trainee be able to discriminate, that is, *not* label nonexamples of physical aggression. Hence the situation under which the trainee is to perform should include both examples and nonexamples of the concept. If the examples are the same as those used during instruction, the trainee's labeling behavior may indicate not mastery of the concept but a good memory. Hence the type of examples presented to him should be new ones. Similarly, the nonexamples used in the testing situation should not be obvious. Friendly behavior is so different from physical aggression that it is not a good test of fine discrimination. On the other hand, examples of verbal aggression or physical resistance share attributes with physical aggression, and discriminations among them indicate a higher level of understanding of the concept. The teacher trainee should be given such close-in nonexamples to test his ability to discriminate.

Another aspect of the range is the media for presenting examples and nonexamples. Whether the teacher trainee is to label pupil behaviors in an actual classroom or on video tape segments makes a difference in his level of performance. Here is the expanded version of the same objective with a specification of the range:

> The teacher trainee shall be shown video tape segments of pupil behavior. Randomly occurring in these segments will be new examples of physical aggression and other behavior, such as verbal aggression and physical resistance. The teacher trainee shall label all examples of physical aggression correctly.

Step 3. Specify reference materials, aids, and equipment which the teacher trainee may or may not use.

The nature of a concept-labeling task changes considerably depending on whether the trainee is permitted to refer to the definition of the concept. Whether to deny access to the definition depends primarily on the situation to which the mastery of the concept is to be transferred. An administrator who must classify a child into a specific legal category may need to refer to definitions and the objective may reflect this need.

> Using the definitions of different handicapping conditions found on page 7, the trainee shall classify each of the ten children for whom detailed data is available.

Usually, however, a trainee is required to classify children's behaviors rapidly—a situation that does not permit the leisurely use of definitions. Hence, in the case of labeling examples of physical aggression, access to all reference materials should be denied. This provision could be incorporated into the objective thusly:

> Without using any reference materials, the teacher trainee shall label. . . .

Step 4. Indicate the standards for acceptable performance by the trainee.

As discussed earlier, mastery of the concept requires that the teacher trainee be able to do two things:

Generalize to new examples by supplying them with the label.

Discriminate nonexamples by not supplying them with the label. The performance standard for the

objective now may be stated as follows:

> The teacher trainee should label all positive examples with the term "*physical aggression.*" He should not apply the same label to other behaviors.

Step 5. Specify a time limit within which the teacher trainee is to perform.

Once again the time limit is to be used only if appropriate. For the last objective, it may be stated as follows:

> The teacher trainee will not be permitted to replay the video tape. Hence his labeling performance should be undertaken within the time provided in the segment.

The statement of the objective is now complete.

> The teacher trainee shall be shown video tape segments of pupil behaviors. Randomly occurring in these segments will be new examples of physical aggression along with similar behaviors, such as verbal aggression and physical resistance. Without using any reference materials, the teacher trainee shall label all positive examples of physical aggression and shall not apply the same label to any other behavior. The teacher trainee will not be permitted to replay the video tape and hence should work within the time provided by the segments.

Concept-generation objectives

Earlier, we discussed a type of objective resulting from concept analysis which requires the trainee to generate products or performances that fall into a specific concept category. For example, in the objectives "write a lesson plan" or "prepare an experience chart," the critical attributes of the concepts "lesson plans" and "experience charts" become the standards for the trainees' products. In some other situations, we may want the trainee's performance to fall into a specific concept category. In such a case, the following example illustrates how concept analysis is converted into a specific objective:

Terminal behavior:	The teacher trainee shall use appropriate empathic controls . . .
Performance range:	. . . during an actual teaching situation in a classroom . . .
Performance conditions:	. . . without any help or prompts.
Standards for acceptable performance:	1. Empathic controls should be used with at least half of the disruptive behaviors by pupils. 2. Empathic controls should immediately follow a disruptive behavior. 3. The teacher should express his understanding of the pupil's feelings. 4. The teacher should relate the child's feelings to his behavior. 5. The teacher should not criticize the child's behavior.
Time limit:	None specified.

Selected bibliography on behavioral objectives

Reprinted by permission; Geis, G. L., *Behavioral objectives: A selected bibliography & brief review.* Stanford: ERIC Clearinghouse on Media and Technology, 1972.

Armstrong, R. J., Cornell, T. D., Kraner, R. E., & Roberson, E. W. *The development and evaluation of behavioral objectives.* Worthington, Ohio: Charles A. Jones, 1970.

A brief, general discussion of objectives is followed by a chapter on behavioral objectives which is aimed at teaching the reader how to critique and write objectives. Later chapters deal with measurement of behavior and incorporating objectives into the evaluation process. Nine self-tests are included. The authors suggest that the book would be useful to administrators and teachers at all levels of education and could be used as a text in teacher-training programs.

Burns, R. W. *New approaches to behavioral objectives.* Dubuque, Iowa: William C. Brown, 1972.

This book "deals extensively with the objectives for instructional settings—their selection, creation, writing, evaluation and use." Exercises and self-check evaluations are incorporated in the book. "Special attention has been given to affective objectives." The author provides discrimination training for the reader on several critical points (e.g., goals *versus* objectives, terminal behavior objective *versus* instructional objective). The examples are drawn from academic disciplines.

Cohen, A. M. *Objectives for college courses.* Beverly Hills: Glencoe, 1970.

This book includes a programed lesson in objectives writing as well as chapters on: Definitions of Terms, Goals and Objectives in Sequence, Implications of the Process, and Criticisms and Caveats. One chapter presents in detail about 100 specimen objectives for various college courses. Appendices include checklists and a bibliography of articles on behavioral objectives.

Gronlund, N. E. *Stating behavioral objectives for classroom instruction.* N.Y.: Macmillan, 1970.

The author explains how to state objectives in behavioral terms and suggests where to get ideas for instructional objectives. Additional suggestions are made concerning how the instructor might use behavioral objectives in measuring student performance. Based on Bloom's taxonomy, the book is aimed primarily at elementary and secondary school teachers.

Kibler, R. J., Barker, L. L., & Miles, D. T. *Behavioral objectives and instruction.* Boston: Allyn and Bacon, 1970.

This book discusses the different types of educational objectives, controversial issues regarding behavioral objectives, the general model of instruction, how to plan objectives, how to write informational objectives and the influence of behavioral objectives in education. Samples of behavioral objectives are given.

Mager, R. F. *Preparing instructional objectives.* Belmont, Calif.: Fearon, 1962.

This programmed book is concerned with designing usefully stated objectives rather than with selecting them. It is by now the classic book on how to write instructional objectives.

Mager, R. F. *Goal analysis.* Belmont, Calif.: Fearon, 1972.

This is a short, breezy text with numerous self-checking and performance posttests. The text aims specifically at teaching the reader how to clarify "fuzzy" goal statements, especially in the area of affective objectives. Upon completion of the book the reader should be able "to identify statements that describe abstractions and those that describe your meaning of the goal." The examples deal with objectives that are quite varied, e.g., "love of learning," "pride in work." The text, while easy to read and humorous, covers many crucial issues in goal analysis.

McAshan, H. H. *Writing behavioral objectives: A new approach.* N.Y.: Harper & Row, 1970.

Each chapter in this paperback text provides a check-test at the beginning. No background in teaching, curriculum development or objective writing is assumed. It is designed to be used individually or in a workshop. Chapters include: Behavioral Objective Components, Developing Goal Statements, Identification of Evaluation Activities, Completing the Writing Process, Unique Writing Problems and Guidelines for Writing Objectives.

Popham, W. J., & Baker, E. L. *Establishing instructional goals.* Englewood Cliffs: Prentice-Hall, 1970.

This book consists of five self-instructional programs which focus on instructional goals: how to select them, how to state them, and how to establish pupil performance standards for such goals.

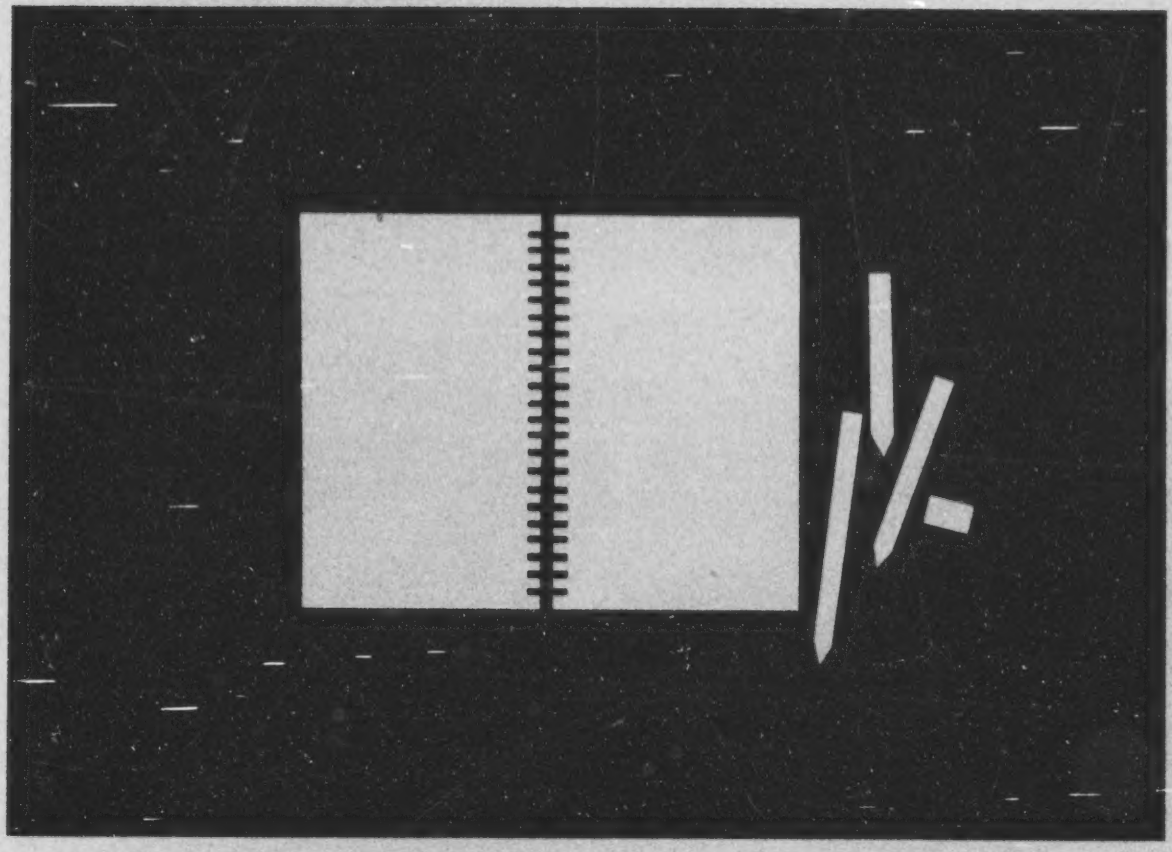
Vargas, J. S. *Writing worthwhile behavioral objectives.* N.Y.: Harper & Row, 1972.

This self-instructional text attempts to teach "the fundamentals of writing (cognitive) objectives and discusses what should be taught and why." It also includes discussions of understanding, concept formation and creativity. Bloom's taxonomy serves as an organizing system. Examples are drawn from a variety of disciplines and grade levels. Pretests, exercises, etc. are included.

Yelon, S. L., & Scott, R. O. *A strategy for writing objectives.* Dubuque, Iowa: Kendall-Hunt, 1970.

This programed text is designed to help teachers write behavioral objectives and to select appropriate tests. It is addressed to the problem of writing objectives for college level instruction as well as for lower levels. A variety of uses of instructional objectives are suggested.

Stage II
Design



Chapter 7
Construction of criterion-referenced tests

Objectives

1. Explain what is a criterion-referenced test and how it differs from a typical norm-referenced test.
2. Explain the relation between criterion-referenced test construction and other aspects of instructional development.
3. Given an instructional objective, design one of these three types of criterion-referenced testing situations: (a) paper-and-pencil, (b) performance under simulated conditions, and (c) performance under natural conditions.
4. Prepare checklists and rating scales for use in performance test situations.

A criterion-referenced test measures the teacher trainee's attainment of instructional objectives. Its construction may be viewed as the process of operationalizing behavioral objectives. Items in criterion-referenced tests are based strictly on instructional objectives, and scoring is based on the standards specified for each objective.

Why construct criterion-referenced tests?

Quality control of instructional materials. A criterion-referenced test can be used to check the effectiveness of instructional material. During formative evaluation, the test enables the developer to locate sections of the materials which need modification. During summative evaluation, the same test is used to demonstrate the effectiveness of the material.

Measurement of teacher trainee's achievment. In actual classroom use a criterion-referenced test measures the degree to which the trainee has attained the instructional objectives. The trainer may use the test *before* instruction to check whether a particular trainee requires training, assign different trainees to different entry points of instruction, and suggest skipping certain sections of instructional material. *After* instruction, the test may be used for computing the gains in the trainee's achievement and to suggest remedial activities, if they are required. *During* instruction, the trainee may use the criterion-referenced test to check his progress.

When to construct tests

We suggest that criterion-referenced tests be constructed even before the design of instructional material, for four reasons:

1. Criterion-test items make the objectives more specific. The construction of the test is, therefore, a logical extension of specifying objectives.
2. By constructing the test first, the developer can consciously avoid using the same items and examples in the instruction exercises.
3. Criterion-referenced test items provide an outline for the instructional material. Borrowing a technique from programed instruction, the developer can arrange test items in a logical sequence of difficulty and then he can design corresponding sequences of instruction. For example, the first section of instruction would begin with the target trainees' entry level and cover the skills and knowledge necessary for them to respond correctly to the first question; the second section would bridge the gap between that level of performance and the level necessary for correct responses to the second question; and this procedure would be repeated until enough sections of the material had been covered to enable the teacher trainees to respond correctly to all the criterion-test items. The procedure of using built-in criterion items as guideposts in instruction is illustrated in Figure 7.1.

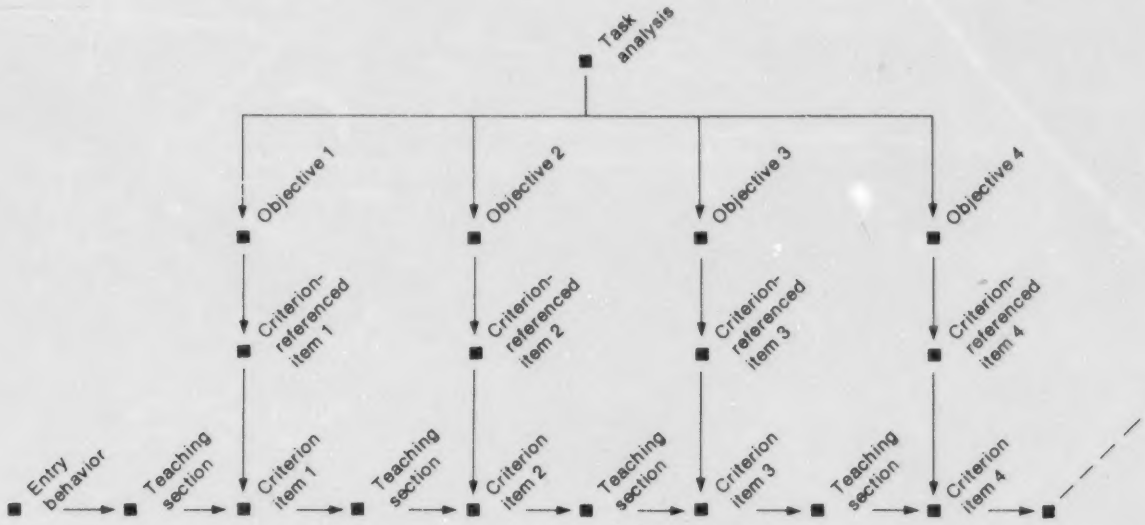


Figure 7.1
Relationship between criterion-referenced test items and teaching sections of the instructional material.

4. In some instances, a set of equivalent criterion-referenced tests may be all that is required for instructional purposes. A number of resource-management formats, described in Chapters 10 and 11, use criterion-referenced tests to help the developer select, evaluate, annotate, and organize existing instructional resources of various types.

Entry tests

A special type of criterion-referenced test is the entry test; it is based upon the specification of prerequisite skills and knowledge. The entry test determines whether a trainee is ready to benefit from the instructional material. It can be used also to diagnose deficiencies and prescribe suitable remedial instruction.

Three levels of criterion-referenced testing

The best test of the trainee's acquisition of new skills and concepts is actual performance under natural conditions. Unfortunately, actual conditions are often contaminated by random factors and administrative problems. Thus, performance under simulated conditions is advisable. It permits standardizing the situation to a large extent and, therefore, increasing the reliability of the test. Another alternative is a paper-and-pencil test. These three levels of testing in relation to the same objective are illustrated in the following example of a test accompanying a set of materials on disruptive behavior:

Three levels of criterion- referenced testing of the mastery of the concept of *aggression*. (Based on Fink & Semmel, 1971)

Objective:

Correctly identify examples of agressive behavior.

Paper-and-pencil test:

Label each of the following examples *va* (verbal aggression) or *pa* (physical aggression). Leave blank if it is not an example of aggression.

A. _____ Pupil: Slams ruler across another pupil's knuckles.

B. _____ Pupil: Draws a circle on the back of his neighbor's shirt with ball-point pen.

C. _____ Teacher: Walking down aisle to help pupil in back row.
Pupil: Sticks out foot and trips the teacher.

D. _____ Teacher: "Put those crayons away."
Pupil: "You're a stupid so-and-so!"

E. _____ Teacher: "John, why aren't you doing your assignment?"
Pupil: "I don't understand the assignment."

Performance test under simulated conditions:

Teacher trainee is shown a four-minute video tape segment of a classroom protocol. At various intervals a "beep" sound is heard. The trainee is to mark down on a special answer sheet whether the behavior of a particular child at that specific point in time is physically or verbally aggressive.

Performance test under natural conditions:

After a regular teaching period, the trainee recalls different occurrences of physical and verbal aggression during that period. His listing is compared with the one made by his supervising teacher observing the same class during the same period.

The following is another example of a criterion-referenced testing situation, also at three levels, this time from a training material dealing with lesson-planning skills for parents.

Three levels of criterion-referenced testing of the skill of preparing specific lesson plans for use by parents.

Objective:

Prepare a specific lesson plan for use by parents in helping their EMR children.

Paper-and-pencil test:

List the essential components of a lesson plan for use by parents.

Performance test under simulated conditions:

William T. is an EMR child with a CA of 14-8. His latest IQ is 72; reading level, 2.9; arithmetic grade, 3.5; and grade expectancy, 4.

William's mother is a housewife with an undergraduate degree.

Prepare a specific lesson plan for use by William's mother to help her child. The lesson plan may be on any topic. You may use any curriculum materials and guides.

The finished lesson plan is due on or before December 5th.

Performance test under natural conditions:

As a part of their job, special class teachers in the Roosevelt School are required to prepare ten lesson plans for parents during the course of each school year.

Testing consists of obtaining and evaluating three randomly chosen lesson plans for each teacher.

Designing a written test

The primary rule in writing a criterion-referenced item is to measure directly and validly the behavioral objective. Compare this objective:

The teacher trainee shall list five critical components of a specific lesson plan for use by parents of exceptional children.

with this test item:

Lesson plans for parents increase the teacher's effectiveness because_____

The last item measures the ability of the trainee to give a rationale for lesson plans for parents. It is irrelevant to the objective, which calls for the ability to list components of a lesson plan, and hence is not criterion-referenced. Now look at the following test item:

All specific lesson plans for use by parents should contain:
a. a set of objectives
b. a set of questions to be asked by the parent
c. a list of words to be emphasized
d. all of the above
e. none of the above

This item is definitely relevant to the objective. However, the performance required by the item (*recognition* of components of a lesson plan) is not the same as the performance specified in the objective (*listing* of components of a lesson plan). Hence the item is not criterion-referenced. The most valid item, of course, will be a restatement of the objective, thus:

List five critical components of a specific lesson plan for use by parents of exceptional children.

Most classroom tests use the multiple-choice format because of reliability and ease of scoring. However, in criterion-referenced tests the type of

item is determined solely by the nature of the objective. A multiple-choice item is used only when the objective calls upon the trainee to *choose* something. In most other cases, constructed responses and short-essay answers should be required. General guidelines for writing test items will be found in any standard test-construction manual. A selected set of these texts are listed in the bibliography at the end of this chapter.

Designing a performance test under simulated conditions

In some respects, simulated conditions are superior to natural ones because it is possible to control and standardize them. For example, let us assume that we are testing the ability of teacher trainees to use specific teaching skills. Under a simulated situation we could give the same lesson topic to different teacher trainees. This standard lesson could be on a novel or even an artificial topic (although representative of the special education curriculum) so that the trainees' previous knowledge and experience would not enter into the picture. For example, the trainee could be asked to teach an imaginary class or a group of his peers in a micro-teaching situation.

A trainee's ability in a performance test may be evaluated by looking at either the procedure or the product. Sometimes we may have to evaluate both, but it is easier to evaluate the product since it permits leisurely inspection. Evaluating an actual performance as it occurs requires reliably trained observers. This task could be simplified by capturing the trainee's performance on video tape and reviewing it repeatedly.

An evaluation checklist or a rating scale should be employed in a simulated situation, regardless of whether a procedure or product is being evaluated. The items in these instruments should be based on the performance standards specified in the instructional objective. A sample of a rating scale for product evaluation is shown below. The product in this example is a set of teacher-prepared lesson plans for use by parents.

A rating scale of teacher-prepared lesson plans for use by parents.

Directions: Rate each item on the basis of 5 points for outstanding quality, 4 points for better than average, 3 points for average, 2 points for below average, and 1 for unacceptable. Circle the appropriate number to indicate your rating.

1. Set of objectives	1	2	3	4	5
2. Number of questions	1	2	3	4	5
3. Types of questions	1	2	3	4	5
4. Word list	1	2	3	4	5
5. List of equipment	1	2	3	4	5
6. Choice of equipment	1	2	3	4	5
7. Suggested schedule of activities	1	2	3	4	5
8. Appropriateness of activities to the child	1	2	3	4	5
9. Quality and finish	1	2	3	4	5
10. Time requirement	1	2	3	4	5

An example of a checklist for evaluation of an instructional procedure (administering an informal reading test) follows. More details on the construction of such instruments may be obtained from appropriate texts listed in the bibliography at the end of this chapter.

Evaluation of trainee's administration of an informal reading test.

Directions: As each teacher trainee administers the informal reading test, observe his procedure and place a check in the blank preceding each step which he fails to use or uses out of sequence.

1. _____ He finds the highest grade level from the child's records.
2. _____ He chooses basal reader at the level of the highest grade.
3. _____ He chooses one 100-word passage from the beginning of the book.
4. _____ He chooses another 100-word passage from the middle of the book.
5. _____ He establishes rapport with the child.
6. _____ He introduces the story to the child.
7. _____ He asks the child to read aloud.
8. _____ He records errors as the child makes them.
9. _____ He stops the child at the end of the passage or when more than five errors are made.
10. _____ He quickly adds up the total number of errors.
11. _____ He readministers the test using another book if necessary.
12. _____ He takes the child back to his classroom.

In the case of concept mastery testing, the simulated situation can include the showing of a film or video tape segment that contains examples and nonexamples of the relevant concepts. Expert judges go through the segment beforehand and come up with a model analysis of the materials. The trainee's analysis is then compared to that of the experts.

Performance tests under natural conditions

Although natural situations do not permit much control over performance conditions, they provide the most valid tests of the trainee's ability to *transfer* his skills to actual working conditions.

Performance testing under natural conditions offers the option of informing or not informing the trainee that he is being observed. Each approach has strengths and problems. Procedures for evaluating the trainee's performance are very similar to those described for simulated conditions. In addition to checklists and rating scales, observation systems that focus upon a few selected aspects of behavior are also very useful. For details of the construction and use of observation systems, refer to Flanders (1970), Roberson (1971), and Simon and Boyer (1970).

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on testing and test construction

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Chapter 8
Media selection

Objectives

1. Justify the use of different media in preparing teacher-training materials.
2. Define the following media attributes and explain their roles in suitable media selection: color, three dimensionality, motion, pacing, random access, sensory mode, and sign type.
3. List basic facts and attributes of the following media: audio tape, print, slide, overhead transparency, film, and video tape.
4. Given information from learner, task, and concept analyses, select the optimum media by matching essential attributes.
5. Make final media selection on the basis of local production and distribution considerations.
6. Locate suitable reference materials on the production of different types of media.

The term "media" means different things to different people. In its broadest sense, it denotes any means of transmitting information. Current usage of the term incorporates both the content (software) and the materials and equipment (hardware). Thus, the term "film media" can refer to the photographic film (material), the projector (equipment), or the instructional message on the film (content).

Not all media are of equal importance in the preparation of teacher-training materials. The media in the following list are potentially useful, however.

1. audio tapes
2. print
3. models
4. real objects
5. filmstrips
6. slides
7. overhead transparencies
8. motion pictures
9. video tapes

Why media?

Media can play an important role in the training of teachers of exceptional children because they permit us to preserve, edit, and distribute instructional information.

Certain media enable us to capture events as they happen, to store them, and to use them at a later time. For example, with motion picture cameras and video tape and audio tape recorders, we can capture the events in a given classroom at a particular time and reproduce them for leisurely inspection at a later time as often as we like. Special classroom protocols can be studied by the teacher trainee until he has acquired all the contained information. Preserving an instructional event not only makes it available for future use but permits its use as a standardized and replicatable base for testing.

By carefully editing a film or tape, we gain a high

degree of stimulus control. We can selectively focus the camera, cut out irrelevant distractions, or even rearrange the sequence of activities. For example, in training teachers to discriminate different levels of classroom questions, we can record all teacher talk in an actual classroom and later edit out everything except the questions. We can also rearrange the sequence of the questions to form categories. We can record the changes in an emotionally disturbed child's behavior over a period of a year and then edit out all but the highlights for a ten-minute film.

The danger inherent in the power of media is the temptation to edit out anything that does not fall within a preconceived framework. With too much editing, the material may turn out to be a simplified but highly distorted version of reality.

Just as the preservation property of media enables an instructional event to travel through time, so the distributive property enables it to travel through space. Thus, by viewing a film, a teacher trainee in Indiana can take an armchair field trip to a special classroom in Texas or to hundreds of other geographically dispersed locations for demonstrations of specialized teaching techniques. The film also can be said to multiply the number of master teachers available for training.

Aspects of media selection

For a long time media specialists have been asking, "Which medium is best suited to portray realistically my instructional content?"

Although realism is very desirable in some situations (e.g., a criterion test), there is no evidence that it is desirable or even necessary during the introductory stages of instruction. Actually, a number of studies suggest that too much realism makes learning difficult. Consequently, the question has been changed to "Which medium is best suited to help my trainees attain my instructional objectives?" Study after study has shown no significant differences among media. This seemingly surprising result is mainly due to the vagueness of the question. For example, when we ask ourselves whether a film, book, or lecture is best suited for teaching some skill, we are using ambiguous terms. When a film shows only the face of a professor talking, it closely resembles a traditional lecture; when it projects printed words, it becomes an expensive page turner. On the other hand, film permits the use of such effective techniques as time-lapse photography, slow motion, color, split screen, and stereophonic sound. Hence, the real question is not *"Which medium?"* but *"Which media attributes?"*

Media attributes refer to variables such as motion, color, and dimensionality. Film and video tape, for example, share the attribute of showing motion. The media selection question now becomes, "What attributes will help my students attain the instructional objectives?" This question involves matching the entry characteristics of learners, requirements of the task, and critical attributes of the concepts to the attributes of media. Once the desired media attributes are listed, we can identify the medium (or combination of media) that has these capabilities. We can then narrow our choice through consideration of production and distribution issues.

Table 8.1 compares the media listed previously on seven attributes, which are then discussed in order.

Color. Real objects, color photographs, slides, and color film are some of the media that share the attribute of portraying color. Although only a few

specialized teacher-training topics (e.g., art therapy for emotionally disturbed children) require the use of color, most teacher trainees prefer color over black and white, perhaps because the motivational effectiveness of the material is enhanced.

Three dimensionality. Models and real objects possess this attribute. In training teachers of exceptional children in the use of a tool or equipment (e.g., braille transcriber, teaching machine, or prosthetic device), the actual object or its model should form an important part of the instructional package to permit meaningful practice.

Motion. Film and video tape possess the attribute of showing motion. In some specialized teacher-training topics (e.g., finger plays for preschool retarded) motion may be an integral part. However, most protocol materials use film or video tape in order to present a total picture of the instructional event.

Pacing. Any medium that permits the teacher trainee to spend as much time on each piece of information as he wants is self-paced. Books, models, and real objects belong to this category. If the rate of instruction is controlled by media equipment, it is

Medium	Color	Three dimensionality	Motion	Pacing	Random access	Sensory mode	Sign type
Audio tape	———	———	———	equipment self	medium	auditory	digital
Print	yes	no	no	self	high	visual	iconic digital
Model	yes	yes	yes	self	———	visual	iconic
Real object	yes	yes	yes	self	———	visual	iconic
Filmstrip	yes	no	no	instructor	low	visual	iconic digital
Slide	yes	no	no	instructor	medium	visual	iconic digital
Overhead transparency	yes	no	no	instructor	high	visual	iconic digital
Motion picture	yes	no	yes	equipment	low	audio visual	iconic digital
Video tape	feasible	no	yes	equipment	low	audio visual	iconic digital

Table 8.1
Media and their attributes.

equipment-paced. Film, video tape, and audio tape are examples of equipment-paced media; once they are set in motion the rate of presentation cannot be controlled. Slides, filmstrips, and transparencies are instructor or group-paced media and in individual situations, they can be self-paced. Sometimes the skill being taught to the teacher trainee may require external pacing, as in the case of rapidly discriminating a type of student response and providing immediate feedback. In these situations, an equipment-paced medium such as video tape is highly recommended. In most other cases, self-pacing is the ideal to strive for, especially since teacher trainees prefer self-paced materials.

Random access. Random access is the degree of referability of the medium, that is, the ease with which the teacher trainee can go directly to any specific part of the instructional material. For example, the teacher trainee can skip sections or go back and forth in a textbook. To do the same with audio tape requires more time and effort, and it becomes very cumbersome to locate a specific section in the middle of a film. Although random access can be added to any medium through electronic means, the process is often prohibitively expensive.

Teacher trainees frequently prefer media with random access which enable them to restructure a sequence, skip known parts, and selectively review materials. If the developer is interested in providing different tracks of instruction according to the teacher trainee's performance and preference, rapid random access is an important consideration.

Sign type. Conveying information through arbitrary signs (e.g., words, numerals, and mathematical symbols) is a verbal presentation. Using signs that resemble what they stand for (e.g., pictures) is a nonverbal presentation. Examples of verbal presentation include a description of a hearing aid on audio tape, a graph plotting frequencies of temper tantrums of an emotionally disturbed child, and a set of written directions on how to furnish a resource room. The same information can be presented nonverbally by showing the actual hearing aid or a film depicting the behavior of the emotionally disturbed child or a floor plan for the resource room. Although an instructional material is rarely exclusively verbal or nonverbal, certain guidelines indicate how a choice should be made. Nonverbal segments are usually better than verbal ones for attracting and holding the attention of the teacher trainee. Also, they encourage open-ended responses. Thus, to elicit a wide variety of solutions to the handling of a problem child, a film or video tape presentation is superior to a printed description. However, nonverbal presentations contain many distractors and irrelevant "noise." Hence, during the initial presentation of a concept, the addition of a verbal explanation will focus the teacher trainee's attention on the critical attributes.

Sensory mode. Most of the media used in teacher training transmit information through the ears or eyes. Educators of the blind find the tactile mode very useful and they make extensive use of real objects, models, and braille materials as media. However, in this section our discussion will be limited to the auditory mode (audio tape), the visual mode (slide, filmstrip, transparency, model, and real object), and the combined audio-visual mode (video tape, film, and slide-tape set).

Table 8.2 lists various factors determining the preference of one sensory mode over the other. Sometimes our media needs may suggest the simultaneous use of both modes, as in the case of the teacher trainee looking at the test profile of a learning disabled child while listening to an interpretation on audio tape. In such audio visual presentations, three combinations are possible.

1. Summative combination:

Relevant picture (e.g., diagram of an ear).	Related narration (e.g., description of how different parts of the ear may be affected, resulting in different types of deafness).

2. Redundant combination:

Verbal message on the screen (e.g., a set of instructions for developing reading readiness in preschool retarded).	Same message presented auditorially (e.g., a tape recording of somebody reading the instructions).

3. Interfering combination:

Irrelevant picture (picture of a deaf child in a classroom).	Unrelated narration (e.g., description of how different parts of the ear may be affected, resulting in different types of deafness).

For teacher training purposes, the second combination is probably irritating and the third one is quite likely ineffective.

From Media Attributes to Media

By using Table 8.1 (Media and their attributes) in relation to the preceding discussion of media attributes, we should be able to answer the basic question, "What attributes will help students attain the instructional objectives?" Once these attributes are listed we can proceed to identify the best medium (or combination of media) incorporating them.

Visual mode is preferred if . . .	Auditory mode is preferred if . . .
Instructional objective involves a visual process or product (e.g., how to prepare experience-activity charts for the classroom).	Instructional objective involves an auditory process or product (e.g., how to give speech correction drills).
The concept or skill involves spatial relationships (e.g., how to arrange a resource room).	The concept or skill involves auditory attributes (e.g., how to provide spoken reinforcement) or temporal attributes (e.g., rhythmic dances for physically handicapped children).
A lengthy verbal statement (e.g., legal definition of mental retardation) or a compressed verbal statement (e.g., formula for computing the ADA) is to be presented.	A short verbal statement (e.g., "Watch this!") or a statement with a high degree of redundancy (e.g., what to do in case of a fire in your classroom) is to be presented.
The material is to be inspected for a long time (e.g., records on a handicapped child).	The material is to be attended only briefly (e.g., a prompt to help the teacher trainee to come up with the correct response).

Table 8.2
Decision table for selecting the most appropriate mode.

An example of the important steps in media selection follows. Notice the specification of learner characteristics and instructional objectives, the identification of essential, desirable, and irrelevant media attributes, and the location of appropriate media combinations.

Media selection for a training module on basic sign language.

Target students:

Inservice teachers from regular classrooms in which deaf students have been integrated.

Instructional objective:

The teacher trainee shall generate and receive 30 common signs for the deaf.

Media attributes:

Essential:
- Ability to represent nonverbal signs (from the sign language)
- Visual mode (to show sign)
- Auditory mode (to describe the signs and to point out critical aspects while the eyes are watching the sign)
- Ability to show motion (since some of the signs involve motion)

Desirable:
- Three dimensionality (to show positions of fingers clearly)
- Self-pacing (since different teachers may require different amounts of time for learning)
- Random access (to permit selective review of difficult signs)

Irrelevant:
- Color

Media selection decisions:

The requirement of motion immediately narrows our choice to film or video tape. Although we are forced to sacrifice three dimensionality, close-up shots from various angles will compensate. Since color is irrelevant, black and white film or video tape is suggested. Film is superior to video tape in realism, but the latter is still acceptable. Neither medium provides self-pacing or random access.

Final Choice of Media:

Video tape or film will be used for initial instruction. Later stages of training will include a booklet with drill practice exercises and an index for selective review.

Although the choice of media should be based primarily upon instructional considerations, it would be naive to assume that they are the only variables. An ideal medium may turn out to be beyond the budget or production capabilities of the developer or unavailable in most teacher-training programs. After the preliminary choice of a medium, consider the various production and dissemination factors which are given in Checklist 8.1.

Checklist 8.1
Production and distribution considerations in media selection

Production factors:

1. **Facilities:** Are production facilities available locally or do we have to go elsewhere? How much delay should we anticipate in the latter case?

2. **Capabilities:** Does someone in the development team have the skills necessary for media production? If not, can we hire someone with specialized technical skills?

3. **Cost:** How expensive is the media production? Does the budget permit it?

4. **Technical quality:** Within the limits of our budget and local facilities, can we produce materials of acceptable technical quality?

5. **Developmental testing:** What special problems will we face in trying out the materials? Will it be expensive and time-consuming to revise the materials? If so, is some other medium available for preliminary debugging (e.g., video tapes instead of film)?

Distribution factors:

1. **Equipment:** What type of equipment will the instructional materials require for presentation? Is this equipment usually found in special education teacher-training programs?

2. **Setting:** Are the instructional materials designed for use with individual learners or groups? Is the type of medium suited for this type of usage?

3. **Cost:** How much will it cost the teacher-training program to purchase the instructional materials? If very expensive, could the materials be rented?

4. **Packaging:** What special packaging problems can be expected? If different types of materials are combined, how can they be kept in the correct order? How much would efficient packaging cost?

Introduction to media facts

The purpose of this chapter is not to transform teacher trainers into media production experts, but to give them some basic facts on different media which can be useful in preparing teacher-training materials. More information can be obtained from the selected bibliography at the end of the chapter.

Audio tape

In most teacher-training instututions, tape recorders are readily available. Reel-to-reel recorders use ¼" wide tape, the reels come in different sizes, and the tape can be recorded at different speeds. In a cassette recorder, the tape is narrower (⅛" wide) and enclosed in a case, which eliminates the need to thread the machine, and recording speeds are not variable. The instrument is especially easy to use. Fairly good quality audio tapes can be made locally although the recording of protocol materials inside an actual classroom presents a number of technical problems and requires special equipment. Among the advantages of tapes is that basic techniques of recording are easily learned and the tapes are easily edited and revised; furthermore, they can be duplicated quickly by commercial specialists.

Audio tape is relatively inexpensive; a finished tape should cost less than $5.00 for an hour of re-

corded time. For detailed information on audio tape production and methods, consult the following references;

Behind the tape—the teacher, tape, 45 min. St. Paul, Minn.: Magnetic Products Division, 3M Company.

Creative teaching with tape. St. Paul, Minn.: Revere Mincom Division, 3M Company, 1969.

Hodgson, D., & Bullen, H. J. *How to use a tape recorder*. N.Y.: Hastings House, 1957.

Nisbett, A. *The technique of the sound studio*. N.Y.: Hastings House, 1962.

Print

Print is the most widely used and versatile medium. Printed materials may range all the way from a dittoed sheet to a high-quality printed book. A wide variety of printing and duplicating techniques are available and most secretaries are familiar with common duplicating procedures. During developmental stages, duplicated materials are inexpensive to revise. It is possible to reproduce copy prepared on an electric typewriter by the offset process. Artwork, photographs, and other graphic materials can also be handled locally. Information on print production techniques and methods is contained in the following texts, and many of the general references on media production listed in the bibliography at the end of this chapter devote sections to print production.

Brunner, F. *A handbook of graphic reproduction processes*. N.Y.: Hastings House, 1964.

Croy, P. *Graphic design and reproduction techniques*. N.Y.: Hastings House, 1968.

Slide

A slide is a color film transparency which is mounted in cardboard or glass. Usually, a set of instructional slides is accompanied by an audio tape and/or a student manual. Slides can be produced with an ordinary 35mm or instamatic camera which, with suitable accessories, can also be used for copy work. Any good photographer can become a producer of usable slides. However, processing must be done in commercial laboratories; several weeks' time is usually required. During tryouts, it is fairly easy to add, remove, and rearrange slides to edit a sequence. Sets of slides can be reproduced in quantity by commercial sources. Each slide costs around $.50. Slide projectors are fairly common equipment in teacher-training institutions.

A number of excellent publications on photography and slide production are available from the Kodak Company. Write to Department 454, Kodak Company, Rochester, New York 14650, for their *Index to Kodak Technical Information*. The following titles may be highly useful:

New adventures in indoor color slides. Publication AE-7. 1967.

New adventures in outdoor color slides. Publication AE-9. 1967.

How to make good pictures. Publication AW-1. 1967.

Producing slides and filmstrips (4th ed.). Publication S-8. 1968.

Also of use is:

Colthorp, J. *Production of 2" x 2" slides for school use*. Austin, Texas: University of Texas, Visual Instruction Bureau, 1958.

Overhead transparency

The transparency is a clear acetate sheet about 8½" x 11" in size which is relatively easy to produce. Visuals may be drawn directly on the acetate sheet or transferred from a paper master. For tryouts, the material can be drawn on paper first and the necessary changes made on them before producing the final version. Overhead projectors are standard equipment in most training programs. The references below list additional information on this medium.

Burtis, E. F., & LeMay, J. E. *They see what you mean.* N.Y.: GAR Corporation, 1959.

Kelley, G. B., & Sleeman, P. J. *A guide to overhead projection and the practical preparation of transparencies.* Leeds, Mass.: Chart-Pak Rotex, 1967.

Projecting ideas on the overhead projector. I-General. 16mm film, sound, color, 17 minutes. Iowa City: University of Iowa.

Projecting ideas on the overhead projector. II-Deazo transparency production. 16mm film, sound, color, 11 min. Iowa City: University of Iowa.

Projecting ideas on the overhead projector. III-Direct transparency production. 16mm film, sound, color, 5 min. Iowa City: University of Iowa.

Film

Sixteen millimeter (16mm) film is best suited for instructional materials. Film may vary in length from one to 50 minutes; longer films must be stored on more than one reel. Film production is a highly technical skill and requires complex equipment. High quality production, especially of classroom protocols, requires the specialized skills of professionals. Revising a film after final production is very expensive. Initial tryouts preferably should be carried out with outlines of the material or video tape versions. Film projectors are fairly common institutional equipment, but they have to be scheduled in advance as a rule. Films are relatively expensive to purchase (average cost of a 10-minute color film is about $120) but they are frequently offered on a rental basis. For additional information on film production, see the following selected references:

Brodbeck, E. E. *Handbook of basic motion picture techniques.* N.Y.: McGraw-Hill, 1950.

Buchanan, A. *Film making from script to screen.* N.Y.: Macmillan, 1951.

Film Problems. 16mm film, sound, black and white, 8 minutes. Bloomington, Ind.: Indiana University.

Spottiswood, R. *Film and its techniques.* Berkeley: University of California Press, 1957.

Video tape

Modern video tape recorders permit local production. The instructional materials can be shot in a television studio or in the classroom using a portable recording unit. A number of persons are required to operate different cameras and microphones. Unlike film, video recordings can be erased and tape reused. Minor changes after tryouts can be handled through editing. For major changes, an entire sequence can be recorded again. Because of their use in other aspects of teacher training, video tape recorders (VTR's) are becoming available in special education teacher training programs. A reel of tape providing an hour of recording time costs around

$30. Half-inch tape is most commonly used. Because it is a relatively new product, standardization of VTR's is not universal and caution should be exercised when investing in equipment to be certain the VTR purchased is compatible with other popular brands on the market. See the selected references listed below for additional information on video tape and television production.

Demonstration kits for utilizing instructional television. III: Preparing the TV lesson. 16mm film, sound, black and white, 28 min. Dekalb, Ill.: National Association of Educational Broadcasters.

Millerson, F. *The technique of television production.* N.Y.: Morgan & Morgan, 1961.

Zettl, H. *Television production handbook* (2nd ed.) Belmont, Calif.: Wadsworth, 1968.

Brown, J. E., Lewis, R. B., & Harcleroad, F. F. *A-V instruction: Materials and methods* (4th ed.) N.Y.: McGraw-Hill, 1973.

Dale, E. *Audiovisual materials in teaching* (3rd ed.) N.Y.: Holt, Rinehart & Winston, 1969.

DeKieffer, R. E. *Audiovisual instruction. N.Y.:* The Center for Applied Research in Education, 1965.

Erickson, S. W. H. *Fundamentals of teaching with audiovisual technology.* N.Y.: Macmillan, 1965.

Gerlach, V. S., & Ely, D. P. *Teaching and media: A systematic approach.* Englewood Cliffs, N.J.: Prentice-Hall, 1971.

Kemp. J. E. *Planning and producing audiovisual materials* (2nd ed.) Scranton, Pa.: Chandler Publishing, 1968.

Kinder, J. S. *Audiovisual materials and techniques.* N.Y.: American Book, 1965.

Minor, E., & Frye, H. R. *Techniques for producing visual instructional media.* N.Y.: McGraw-Hill, 1970.

Wittich, W. A., & Schuller, C. F. *Audiovisual materials: Their nature and use* (3rd ed.) N.Y.: Harper & Row, 1962.

Chapter 9
Format selection

Objectives

1. Differentiate between protocol and training materials in teacher preparation.
2. Differentiate between instructional management formats and content-design formats in training materials.
3. Explain briefly and give examples of resource-management, mastery-learning, print, multimedia, small-group, and computer-based formats.

The term "instructional format" is a difficult one to define; it refers to a combination of media, teaching strategies, and utilization techniques. Sometimes format is used synonymously with medium, as in *television format;* often it goes beyond media, as in *self-instructional formats* which use different media; sometimes it refers to sensory mode (e.g., *visual format* and *audio-visual format*) and sometimes to sign type (e.g., *nonverbal format*); and frequently the term refers to external characteristics, as in *textbook format* or *lecture format.*

All instructional materials for the preparation of teachers can be divided primarily into protocol and training materials. Training materials can be further subdivided into management and content-design formats. The classification of instructional formats is shown in Table 9.1.

Protocols

Protocol materials are records of real or realistically staged instructional behaviors. They are used to exemplify various educationally relevant concepts.

Basically, protocols may be designed in three different formats, depending upon the control we exert over the behaviors recorded. At one extreme is a scripted drama that permits total control; at the other extreme we may record uncontrolled behaviors in an actual classroom and edit out all but relevant excerpts. Somewhere in between are minimum structure protocols that involve recording a loosely structured roleplay.

Classification of instructional formats

Protocol materials (Chapter 10)	Training materials	
	Management formats	**Content design formats**
Scripted protocols	Resource-management formats (Chapter 11)	Self-instructional print formats (Chapter 13)
Edited excerpts	Objective outline	Textbook/handout
Minimum structure roleplays	Resource list	Information mapping
	Field training	Programmed instruction
	Mastery-learning formats (Chapter 12)	Self-instructional multimedia format (Chapter 14)
	Adjunct programming	Audiotutorial module
	Repeated testing	Multimedia module
	Personalized system of instruction	Minicourses
		Small group formats (Chapter 15)
		Roleplay
		Instructional games
		Simulation
		Computer-based formats (Chapter 16)
		Computer-assisted instruction "CARE"
		Computer administered repeated testing
		Computer-assisted teacher skill training "CATTS"

Table 9.1

Training materials

Training materials deal with the acquisition of performance skills in teaching situations. They may be subdivided into management and content-design formats. Following the specification of objectives in the instructional-development process, we may decide to use already existing instructional resources. What is needed in this case is a management structure to help the trainee choose the most suitable resources and use them selectively. The following two major formats use the management approach:

Resource management formats. A suitable management format can be based on behavioral objectives arranged in a hierarchical sequence. Perhaps all the trainee needs is this outline of objectives. However, we could offer him more by locating different resource materials, persons, and institutions and keying them to our different objectives. We could also suggest various activities (reading, visiting, interviewing, and discussing) which will enable the trainee to attain the objectives effectively.

Mastery learning formats. Continuing a little further in the instructional-development process, our objectives can be converted into criterion-referenced tests and used as the basis for instructional management. Bloom and his associates (1971) have suggested a mastery-learning format in which criterion-tests are repeatedly taken by the trainee until he achieves a prespecified standard. In this case, test taking becomes an instructional strategy for identifying areas of weakness and remediating them. Criterion-test based formats require the design of equivalent versions of the test and devising strategies for scoring large numbers of tests and providing immediate feedback to the trainee.

Content-design formats

Another type of training materials involves the design and development of *new* materials. These may be further divided into the following four formats:

Self-instructional print formats. Printed individual-use materials are fairly inexpensive to produce and permit flexible usage. Programed instruction is an example of print format made effective through the systematic application of the instructional-development process.

Multimedia self-instructional formats. These are instructional modules for individual trainees to be used in learning carrels. Mediated modules require more time and effort to produce than do printed materials but they are usually more effective and motivating.

Formats for small-group learning. Instructional materials in this group are designed to require interaction among different trainees. The formats include roleplay, instructional games, and simulations, all of which encourage the trainees to learn from each other. Small-group formats are especially useful for attaining affective and social outcomes.

Computer-based formats. Overlapping the self-instructional and group formats are several materials which are identified by their dependency upon the computer. The imaginative use of the computer enables us to accomplish high cost-effectiveness which is otherwise not feasible.

Selecting a format

The next seven chapters of the sourcebook deal with groups of instructional formats. Each chapter provides examples of instructional materials in each format, taken wherever feasible, from existing materials used for training teachers of exceptional

children. Guidelines for the design of materials in each format are also provided. Depending upon the complexity of the format, the adequacy of these guidelines varies. For example, we have not detailed the design of computer-based formats. In all cases, however, we have provided references to books, articles, and mediated resources that basically offer "how-to-do" instructions rather than theoretical discussions.

Although the superiority of a particular system is usually extolled by its practitioners, we must caution readers against becoming single-format developers. We recommend exploration of all 21 format variations before settling on a specialty. There are no simple guidelines for the selection of format. Other than certain obvious aspects (e.g., for affective outcomes, small-group formats are preferred), format selection depends upon a number of factors including available resources, plans for dissemination, project deadlines, and the subjective preferences of the developer.

Chapter 10
Protocol materials

Objectives

1. Describe the nature of protocol materials and explain their role in the preparation of teachers of exceptional children.
2. Select the number of concepts, length, type of media, nature of adjunct materials, and degree of staging for protocol materials on a suitable educational topic.
3. Specify examples and nonexamples to be used in the protocol through an analysis of selected concepts.
4. Using any one of the three procedures recommended in the chapter, produce protocol materials.

Protocol materials are records of real or realistically staged behaviors. Originally, protocols were narrowly defined as unedited records of unrehearsed behavior. Because producing such records is often too wasteful and unpredictable to be relied upon, current protocols are usually edited excerpts or scripted productions on audio or video tape, or film. The purpose of a protocol is to provide a raw-data base for exemplifying theoretical concepts. However, protocols are not portrayals of model behaviors. They are not accompanied by any interpretative narration. What each teacher trainee sees in the material depends upon the conceptual framework he brings to it.

Protocols provide concrete referrents to various educationally relevant concepts. In this way, they are superior to the traditional text-and-lecture approach to teaching concepts. The use of protocols also offers certain advantages over observations of actual classrooms because of fewer logistic and administrative problems and tighter control over the types of behaviors recorded. On the negative side, the attempt to portray the realities of the classroom may result in dull and uninspiring protocols. The lack of strong story lines, outstanding performances, and closure may make the viewers uncomfortable the first time they view a protocol. To an audience accustomed to slick production, the apparent pointlessness and blandness of a protocol can be very disquieting. Sometimes protocols reflect the unconscious biases of the producer, despite his honest efforts to be entirely neutral.

Although the guidelines for the design of training materials overlap to some extent with the design of protocol materials, this chapter deals with issues which are unique to the preparation of protocols.

Nature and number of concepts. In special education, protocol materials usually deal with those

concepts that are both behavioral and interactional. Asking questions, counseling parents, providing response feedback to retarded children, and behavior management are a few examples. Within a selected domain, a protocol should portray no more than four or five major concepts. These concepts can be antithetical pairs of behaviors (e.g., accepting and rejecting) or sublevels of the same general concept (e.g., low-level cognitive tasks: imitating, repeating, observing, and describing). Parenthetically, it should be noted that in the first example some problems of authenticity may arise if the same teacher is used to portray both behaviors.

Length of protocols. Our experience in field testing a number of protocols with trainees suggests that the ideal length is about 5-7 minutes. Because protocols do not have a story theme, a trainee's attention is not usually sustained nor is he always able to recall some of the early segments, if the protocols are longer. Larger domains of concepts can be effectively portrayed in a series of short protocols in which primacy and recency effects are less likely to have an impact on trainee responses to the materials.

Media selection. The protocol can be a printed script, an audio tape, or a film. To record purely auditory-verbal interactions (spoken words), audio materials may suffice. However, since the ultimate objective of protocol materials is to provide the trainee with conceptual tools to interpret what is happening in a classroom with all its rich distractions, an audio visual medium (video tape or film) is strongly suggested. Authenticity and realism are very important in protocol materials. Unless the video tape is of studio quality, the most effective medium is color film.

Adjunct materials. Protocols may be used in a number of different ways. At one extreme, they are left open-ended to be used at the discretion of the trainer. At the other extreme, they are incorporated into a closely-knit system with volumes of paper-and-pencil training materials.

Staging vs real life. Originally, protocols were meant to be unrehearsed and unstaged events in the classroom. Currently, however, according to Gliessman (1972, pp. 5-6), "It is clear . . . that the original conception of protocol material as an unedited documentation of behavior was an imperfect one. 'Critical' behaviors do not always occur with sufficient frequency or clarity in on-going situations to be 'captured' by means of documentary techniques. In one way or another, the developers of the pilot materials have found it necessary to assure the occurrence and to increase the salience of the behavior exemplifying the concepts they have selected." Three different formats "to assure the occurrence and to increase the salience of the behavior" are described later in this chapter. An understanding of these formats requires familiarity with concept analysis (Chapter 5).

Concept analysis as the base for preparing protocols

A number of instructional strategies (e.g., Markle & Tiemann, 1971) are available for prescribing examples and nonexamples for instructional materials. They are based on the analysis of a concept into critical and irrelevant attributes. Successful mastery of a concept requires that the trainees *generalize* to the full range of examples of the interactional behaviors and *discriminate* even very fine nonexamples. To achieve these outcomes, a wide variety of examples and close-in nonexamples should be portrayed in the protocols.

The list of irrelevant attributes of a concept helps

to determine the range of examples to be used. Irrelevant attributes, by definition, are those by which examples may vary without losing their membership in the concept category. Examples in a protocol must reflect the total possible range of irrelevant attributes. For example, one of the irrelevant *attributes* of the concept physical aggression, which was identified in the discussion of concept analysis (Chapter 5), is the *target* of aggression. It does not matter whether the child attacks another child, the teacher, or someone else. If all examples in the protocol depict only aggressive acts against other children, the teacher trainee may not be able to generalize this concept to the instance in which a child attacks the teacher. Table 10.1 illustrates how different examples are generated from the set of irrelevant attributes of the concept *pupil physical aggression.*

Irrelevant attributes	Examples of variations of the irrelevant attributes
Target of aggression	1. Mary fighting with *John.*
	2. Mary fighting with the school *nurse.*
	3. John fighting with his *teacher.*
	4. Mark fighting with four other *children.*
Form of aggression	1. Mary *kicking* someone else.
	2. John *throwing* a book at the teacher.
	3. Mary *biting* the school nurse's hand.
	4. Mark *punching* and *hitting* others.
Verbal accompaniment	1. John screaming insults while pulling Mary's hair.
	2. Bob silently tripping Mark.
Retaliation	1. An unprovoked aggression.
	2. "She hit me first!"
Location	1. A fight in the *classroom.*
	2. A fight in the *playground.*
	3. Aggression in the *cafeteria.*

Table 10.1
Development of examples from the list of irrelevant attributes of the concept *physical aggression.*

The list of critical attributes helps us to specify nonexamples for portrayal in the protocol to strengthen discrimination. Close-in nonexamples are behaviors that lack only one of the total set of critical attributes. For example, one of the critical attributes of the concept *pupil physical aggression* (in the special sense of the term) is that it is an act of a *pupil*. By eliminating this critical attribute and retaining all others we come up with this nonexample:

> Tom swears in the class. The teacher, Mr. Cooper, grabs him by the shoulder and swats him, saying, "I'll teach you never to swear in this class again!"

Mr. Cooper's behavior has all the other attributes of physical aggression—it is off-task, interactional, unfriendly, and physical—but it is not a pupil's act and, therefore, should not be classified as an example of physical aggression. Through nonexamples of this nature we strengthen the trainee's understanding of the boundaries of the concept. Table 10.2 illustrates the systematic use of critical attributes to generate a set of nonexamples.

The next step in working out a prescription for the protocol is the sequencing of examples and nonexamples for efficient instruction. The following guidelines are based upon a number of concept-acquisition studies (Clark, 1971).

Begin with clear-cut positive examples of the concept. For the protocol on *pupil physical aggression* we may begin with an incident like this:

> The children are instructed to work on their individual assignments. Mark whispers to Mary, "You have an ugly face!" Mary jumps up, visibly infuriated, and starts punching and kicking Mark. The teacher steps in and separates them.

All the critical attributes of *physical aggression* are salient in this example; it clearly involves a pupil physically interacting with another with anger and hostility. In this incident the critical attributes are

Critical attribute	Nonexamples generated by ommission of the critical attribute
An act by a *pupil*.	Tom swears in the class. The teacher, Mr. Cooper, grabs him by his shoulders and swats him, saying, "I'll teach you never to swear in this class again."
Pupil is *not* working on the task assigned by the teacher.	The teacher is refereeing a wrestling match. Jim has his knee sticking in John's stomach and tries to pin his shoulders to the mat.
Pupil interacts with *some other* person.	Susan takes a pair of scissors and starts cutting up her dress. She is definitely angry about something.
The interaction is *physical*.	Mr. Cooper asks John, "Who invented the automobile?" John gets very angry and shouts back, "Who cares! You always pick on me. I hate your guts!"
The interaction is intentionally *unfriendly*.	Mr. Cooper asks the pupils to work by themselves on their tests. John tickles the girl in front of him.

Table 10.2
Development of a set of nonexamples by omitting one critical attribute at a time.

intrinsically salient. We may also extrinsically increase the saliency by using suitable camera techniques. For example, we can show a shot of the assignment on the blackboard (to remind the viewer that the fight is definitely off-task), add a close-up of Mary's face to depict the anger and hostility and freeze the action at the moment Mary's punch lands on Mark's stomach. We can have an instant replay to emphasize all the critical attributes. Usually, however, we should be able to build saliency into the actions of the children without resorting to excessive photographic manipulation.

Continue with more examples in which the critical attributes become gradually more subtle. From the wide range of examples we have developed from irrelevant attributes, we can now introduce those which are not so clear-cut. This procedure increases the range of behaviors to which the teacher trainee must generalize.

Introduce nonexamples. We may now introduce those close-in nonexamples prescribed from critical attributes to ensure the trainee's ability to discriminate. To begin with, a nonexample may be presented immediately following an example which matches it in all respects except for the missing critical attributes. Here is an example of such a matched pair:

Example
A sign on the chalkboard says: "Assignment: pages 32-35." Most of the children are at their desks working on their assignment. Jim and John are fighting on the floor. Jim has his knee in John's stomach and is trying to pin him down, grunting, "You rat. Don't ever call me a moron again, or I'll knock your teeth in next time."

Nonexample
A sign at the gym door says, "Practice match today." The children are in their gym outfits and the teacher is refereeing a wrestling match. Jim has his knee on John's stomach, and is trying to pin his shoulders to the mat, grunting, "Come on . . . let's see you get out of this one."

Introduce a random set of examples and nonexamples. At this stage, trainees are ready to face more realistic and unplanned incidents in the classroom.

Alternative formats for preparing protocols

Format I: Scripted protocols

All these specifications and the sequence for different behaviors to be portrayed could be incorporated into a script for a classroom drama. This play could then be produced like any other play and shot on film. A number of high-quality protocols have been produced in this manner. However, the format has two major disadvantages: The time and resources needed for production are fairly high and the final product frequently lacks authenticity unless the acting is of professional quality.

Format II: Edited excerpts

This format begins with a large pool of unstaged protocols from an actual classroom. A hidden camera, or a camera which turns itself on and off on a random basis over a long period of time, may be used to prevent the teachers and pupils from becoming inhibited or showing off. Once the pool of

behaviors is obtained, it is analyzed carefully for relevant segments. These segments are further classified into examples and nonexamples and arranged in order of their saliency. The final version of the protocol is prepared by splicing the segments together according to the sequence indicated earlier.

A number of effective protocols have been produced in this format and they provide a wide variety of realistic behaviors. With rapid switching from one short segment to another, the teacher trainee's attention is maintained for a longer period of time. However, these protocols lack continuity and present a disjointed appearance. Further, because of the expense involved in shooting the original pool, we are limited to the use of video tape.

Format III: Minimum structure simulations

Somewhere in between these two formats is the *in situ* roleplay in which the general nature and sequence of the conceptual referrents are guaranteed, although specific details are unpredictable. Here are some guidelines for producing minimum structure simulation protocols.

☐ Based upon the concept-analysis specifications, select a suitable situation in which behavioral examples are to be portrayed. Specify the type of classroom, number of children, and content of the lesson.

☐ Select a teacher and a set of pupils for a loosely-structured roleplay. Explain the details of the lesson to the teacher and specify the general class of behaviors he is to exhibit. Within these constraints, he is free to "do his own thing." Most of the children are merely told to behave as if they were in their own classrooms. Some children receive cue cards with directions like these:

> When the director holds up a card with the number 9, start pulling your neighbor's hair. Do this gradually. If and when your teacher notices it and talks to you, do exactly what you would do if you were in your classroom.

☐ Conduct some rehearsals to adapt the players to microphones and cameras and to make sure everyone knows his role. During these rehearsals make note of any special talent pupils may have for portraying roles in later segments.

☐ Shoot the protocol in short segments. Between these segments give feedback and distribute new cue cards. If unsuccessful in getting across some important behavior, try again in the next segment.

Suggestions for further reading

Babick, A. & Gliessman, D. Nature and systematic use of protocol materials in teacher education. *Viewpoints*, 1970, **46**, 129-138.

Hudgins, B. B. The portrayal of concepts: An issue in the development of protocol materials. In *Acquiring teaching competencies: Reports and studies, Report I.* Bloomington, Ind.: National Center for the Development of Training Materials in Teacher Education, 1971.

Chapter 11
Resource-management formats

Objectives

1. List the important features and provide examples of the resource management format.
2. Prepare an objectives outline package for a suitable instructional topic. This package should include specific objectives arranged in sequence, a criterion-referenced test based on the objectives, and a directive explaining the use of the package.
3. Prepare a resource list on a suitable topic keyed to instructional objectives. This package should include specific objectives arranged in sequence, textual and mediated resource materials related to each objective, a criterion-referenced test based on the objectives, and a directive explaining the use of the resource list.
4. Prepare a field-training package on a suitable instructional topic. This package should include lists of human and institutional resources and criterion assignments in addition to the materials found in the preceding format.

Resource-management formats systematically structure the use of existing teacher-training materials. As in the development of any other instructional materials, the trainer begins by defining instructional requirements.

We have identified three resource-management formats: *objectives outline*, *resource list*, and *field training*. In the first, only objectives and criterion tests are given to the trainees. What happens in between is left to the ingenuity of the trainees. In the second, the resource list format, the trainee is provided with an additional annotated list of resource materials. More clues to and contact with human and institutional resources are provided for the trainee in the competency-based field-training format.

These three resource-management formats are compared in Table 11.1. Later, each format is described in detail and one or more examples from the training of teachers of exceptional children are provided. Step-by-step procedures and useful references for the design of instructional structures in each format are also given.

I. Objectives outline

Based on the assumption expressed by Mager (1962), "If you give each learner a copy of your objectives, you may not have to do much else," this format is best suited for those units in which alternative resource materials are available, and for in-service training situations in which there is no great time pressure. The developer may begin with this format and gradually move into more sophisticated versions, such as those described in a later section of this chapter.

Format	Items included in format	Instructional resources
1. Objectives outline	Behavioral objectives arranged in a hierarchy. Criterion tests and assignments.	Left to the teacher trainee's ingenuity.
2. Resource list	Behavioral objectives. Resource lists keyed to the objectives. Criterion tests and assignments.	Textbooks, articles and research reports. Mediated resource materials (films, etc.). Supplementary handouts.
3. Field training	Behavioral objectives. List of resource materials and resource persons. Field-placement tasks. Criterion tests and assignments. Performance tests.	Existing textual and mediated resources. Professionals and experts in the field.

Table 11.1.
Resource-management formats for training teachers of exceptional children.

An example of the objectives outline format

On the first day of a course, teacher trainees are given the directive shown in Figure 11.1. Anytime before the end of the course, they take the criterion test, which is just a reproduction of the objectives.

Alternative administrative structures to help handicapped children

Handicapped children may be served through a variety of administrative structures. Each of these has its own strengths and weaknesses. As a prospective teacher of the handicapped, it is essential that you are familiar with these administrative structures.

Given below are a set of behavioral objectives. You are required to attain all of them before the end of this semester. Information needed to master these objectives is available from a number of different textbooks and pamphlets in the Special Education Reading Room.

This is just one of the many requirements of this course. Schedule your time suitably. Any time you are confident that you have attained all the objectives, check with your instructor. He will give you a criterion test which is solely based on these objectives.

Objectives

1. Briefly describe the essential characteristics of each of these educational structures from the point of view of handicapped children:

   Educational mainstream
   Integrated special class
   Adjusted regular class
   Informal classrooms

   Your description should include the rationale for the structure, its strengths and weaknesses, and physical characteristics. You should be able to provide the descriptions without any references.

2. Describe a resource room and explain its relationship to a regular classroom.

3. Compare and contrast these four types of teachers:

   Itinerant teacher
   Resource teacher
   Consulting teacher
   Remedial teacher

   Your response should take into account the roles, areas of expertise, and training of each type of teacher.

Figure 11.1
A sample instructional handout illustrating the objectives outline format.

Guidelines for the design of objectives outlines

☐ Conduct a task analysis and/or concept analysis as described in Chapters 4 and 5.

☐ Derive objectives and state them in specific behavioral terms. Include appropriate range, condition, standards, and time limit for the performance of each objective. A statement of rationale indicating the relevance of each objective to the teacher of exceptional children may also be included.

☐ Rewrite the objectives in language meaningful to teacher trainees.

☐ Arrange the objectives in the logical sequence suggested by the task analysis.

☐ Have other teacher trainees rate each objective on necessity, relevance, and importance. Revise suitably.

☐ Have teacher trainees arrange the objectives in a hierarchical order. Revise the task analysis suitably.

☐ Try out the objectives on a few teacher trainees to determine clarity. Rewrite the objectives on the basis of their reactions and suggestions.

☐ Construct a criterion-referenced test based on the objectives.

☐ Prepare a handout to teacher trainees explaining what is expected of them and suggesting a schedule.

II. Resource lists

This format is an extension of the objectives outline format. In addition to the set of objectives, the teacher trainee is provided with a coded list of resource materials to help him attain these objectives. This format is suitable for longer instructional segments and for entire courses as well.

Examples of the resource list format

Two examples of the type of information supplied to the trainee follow. Each example is just one section of a longer unit with other sections arranged in a sequential order.

Punishment and threat in the classroom

Objectives

1. Given 20 episodes of teacher control from a class for emotionally disturbed, you will classify them according to whether punishment or threat was used.
2. Give acceptable definitions of punishment and threat as teacher control techniques without using any references.
3. Discriminate between punishment and threat and give examples of each.
4. Explain the relation between punishment and self-esteem.
5. List specific categories of deviant behaviors which are more amenable to punishment and threat than other control techniques.
6. List precautions to be observed by the teacher in using punishment as a control technique.

Reading list

Ausubel, D. A new look at classroom discipline. *Phi Delta Kappan*, 1961, 43, 25-30.

Clarizio, H. F. *Toward positive classroom discipline*. N.Y.: Wiley, 1970.

Homme, L. E. What behavioral engineering is. In N. G. Haring & A. H. Hayden (eds.), *The improvement of instruction*. Seattle: Special Child Publication, 1972, 154-169.

Long, N. J., & Newman, R. G. Managing surface behavior of children in school. In N. J. Long, W. C. Morse, & R. G. Newman (eds.), *Conflict in the classroom*. Belmont: Wadsworth, 1971, 442-452.

Redl, F. *When we deal with children: Selected writings*. N.Y.: The Free Press, 1966, 254-308.

Redl, F. The concept of punishment. In N. J. Long, W. C. Morse, & R. G. Newman (eds.), *Conflict in the classroom* (2nd ed.). Belmont: Wadsworth, 1971, 434-441.

Vernon, W. M. *Motivating children*. N.Y.: Holt, Rinehart, & Winston, 1972, 19-28 and 47-51.

A sample resource list from a unit on behavior-management techniques.

Objective

List tests which can be used to assess the need for special education placement and indicate their appropriateness for children of low socioeconomic status. The list should contain tests which are useful in the identification and evaluation of learning disorders and should include at least one intelligence, perceptual, reading achievement, diagnostic language, screening and readiness, and social competence test.

Resource materials

Buros, O. K. (Ed.) *The seventh mental measurements yearbook*. Highland Park, N. J.: Gryphon, 1972.

Frierson, E. C., & Barbe, W. B. (Eds.) *Educating children with learning disabilities*. N.Y.: Appleton Century, 1967 (Section III, Diagnosing learning disorders).

Gearheart, B. R., & Willenberg, E. P. *Application of pupil assessment information for the special education teacher*. Denver: Love, 1970.

Robinson, H. B., & Robinson, N. M. *The mentally retarded child: A psychological approach*. N.Y.: McGraw Hill, 1965 (Part 5, Psychodiagnosis).

A sample resource list from a unit on special education placement.

Guidelines for the design of resource lists keyed to instructional objectives

In addition to completing the steps listed for the development of a hierarchy of objectives (in the guidelines for the design of objectives outlines), perform the following tasks:

☐ Collect all available materials in the subject-matter area. In addition to using familiar materials, ask colleagues for their suggestions. Ask trainees who have previously taken the course for their opinions of different texts. Publishers' catalogs are also useful in this step.

☐ Do not limit resource list to textbooks. Locate current articles in popular and professional journals. A CEC/ERIC search will be helpful.

☐ Do not limit resource list to printed materials. Some useful mediated resources are available. The media guides listed at the end of Chapter 2 will be helpful.

☐ Obtain copies of text and resource materials. Select the most promising set, go through each carefully, and find specific references to your objectives. The more specific the references (page number rather than the chapter) the more useful the list becomes.

☐ If some objective is not covered by any available material, prepare your own handout.

☐ Prepare handouts for teacher trainees listing the objectives and specifying alternative resources. Indicate a rating of each resource using some convenient coding.

☐ Update the lists by reviewing and adding additional instructional resources. Collect student feedback on the strengths and weaknesses of each resource throughout the course. By considering these reactions, decide to drop any material which is seldom used or extremely unpopular, or change the ratings of different resources.

III. Field training

In addition to textual and mediated resources, a number of human resources are available for training teachers of exceptional children. Professors, classroom teachers, supervisors, school psychologists, special education directors, curriculum coordinators, and the children themselves have much to offer to the training of teachers. The field training format will be found especially suitable during the final stages of academic preparation or the initial stages of work in a real classroom.

Providing the teacher trainees with sets of objectives, indicating where various resource people are available, and setting up a procedural system for interviewing them, constitute an effective training package. An excellent example of this format, in conjunction with the reading list format, is seen in Korba, Cawley, and Pappanikou (1972), *Special Education Placement: A Decision System Module*. Behavioral Objective Number 15 and the criterion assignment from this material are shown in the next column.

Steps in the design of such a *competency-based field training* package are similar to the steps listed for the earlier formats. The additional step consists of locating and listing appropriate human resources.

Behavioral objective number 15

As a result of tasks 15.01 through 15.04 you will develop a system for handling complaints within an elementary school. Criterion will be met by having an acting principal agree in writing that the system you develop could work in *his* school.

Task 15.01

In a discussion with a principal, outline in writing the system he uses to handle complaints in his school.

Task 15.02

Repeat task 15.01 in a second school.

Task 15.03

Ask a professor in educational administration to recommend three references on the topic. Record the references and read the material.

Task 15.04

Develop your system and present it to a practicing principal along with the attainment form corresponding to Objective 15.

A sample competency-based field-training segment (Korba, Cawley, & Pappanikou, 1972).

Attainment of behavioral objective number 15

_____
(name of student)
has outlined a system for handling complaints that seems workable within my school (this does not imply that I will adopt the system).

Signature _____
(Principal)

School _____

Date _____

Turn this sheet in to your instructor/discussion leader and begin working on Behavioral Objective Number 16.

Assignment sheet from a field-training unit (Korba, Cawley, & Pappanikou, 1972).

Chapter 12
Mastery-learning formats

Objectives

1. Give examples of the mastery-learning format and list the common elements of instructional materials using this format.
2. Prepare an adjunct program to accompany a chapter or a text. Design a system for the trainee to test himself and obtain feedback.
3. Design a module in the repeated testing format.
4. Design a course using the personalized system of instruction method. This design should include the strategy for running the system, procedures for recruiting and training proctors, guidelines for taking tests, and policies for assigning final grades. Also, write suitable manuals for trainees and proctors.

The common element in the three types of mastery-learning which are discussed is formative evaluation through repeated testing, as expounded by Bloom and his associates (1971). In these formats, the trainee goes through the following procedures:

1. Learning from a variety of instructional materials.
2. Taking a criterion-referenced test.
3. Obtaining immediate feedback on the objectives he has not yet attained to the required criteria.
4. Studying again the original instructional materials or new ones, if available.
5. Taking the same test (or an equivalent version).
6. Repeating this process as often as necessary until specified criteria are attained.

The three mastery-learning formats are compared with each other in the following. Each format is then described, and step-by-step procedures are provided for the design of instruction.

I. Adjunct programing

Adjunct programing provides many of the advantages of programed instruction but requires less development time. This format evolved out of Pressey's (1927) studies with a machine which taught and tested the learner. Adjunct programing permits the incorporation into the test feedback process of references to pertinent textual materials. It is especially useful when the instructional task involves large amounts of factual information.

Format	Initial Instruction	Test	Feedback
Adjunct programming	Textbook chapter or a handout	Self-scorable objective test	Student scores his own test, usually with the help of some mechanical aid (e.g., a punchboard). Scoring key provides references for remedial review.
Repeated testing	Alternative instructional resources keyed to behavioral objectives	Repeatable versions of objective criterion-referenced test	Instructor scores test, provides feedback and prescribes remedial instruction.
Personalized system of instruction	Textbooks and alternative resources, peer tutoring	Criterion-referenced tests and oral interviews administered by advanced teacher trainees	Feedback from an advanced teacher trainee who administers tests and interviews.

Figure 12.1
Mastery learning formats.

An example of adjunct programing

In the following example, a few sample items from an adjunct program which accompanies the *Administrative Guide and Handbook for Special Education* (Texas Education Agency, 1971) are shown. It is used for the inservice training of administrative personnel. The trainee uses the *Guide* for initial instruction and tests himself on objective items similar to those shown in the example. Along with the test, he is also provided with a small punchboard device that consists of 80 sets of perforations, 4 to a set and numbered 1 through 80, corresponding to the item numbers, on which he punches his answers. If he is right, the pencil point goes through the paper; if not, it stops at a backing sheet and the trainee must make another choice. He continues in this manner until he has punched the correct choice for all items. In the end, he is left with a record of his errors; if they exceed 15 he is advised to reread the sections of the *Guide* corresponding to the questions he missed. (The numbers below each item number on the test are the page and section references.) The trainee may retake the test to check his mastery. The punchboard can easily be adjusted to give different patterns of correct response positions, and any number of rearranged versions of the test can be created.

14. (25/2.7) Inservice training for special educational personnel in the better utilization of instructional media is one of the services provided by
a) local school boards.
b) Special Education Instructional Materials Services.
c) Department of Audiovisual Instruction.
d) Regional Educational Service Centers.

15. (19/2.6) The primary purpose of the special education visiting teacher is to provide
a) leadership for instructional improvement of exceptional children through working with teachers and other school personnel.
b) assistance to the appraisal team and aid in designing suitable instructional techniques and strategies.
c) information relative to the mental ability and behavioral characteristics of exceptional children.
d) liaison between the school, home, and community.

16. (14/2.5) The coordination component of diagnosis
a) appraises the psychomotor coordination of the child.
b) determines the child's general level of educational ability.
c) evaluates the child in his home environment.
d) coordinates information from appraisal specialists and classroom teachers.

17. (65/5.1) Allocations to Rehabilitation Districts for Handicapped Persons are financed
a) entirely by the Federal government.
b) entirely by the state.
c) entirely by the local school districts.
d) none of the above.

18. (9/2.4) A child who has a deficit in all learning processes between 2 and 3 standard deviation units below the mean of the general population is
a) auditorially handicapped.
b) minimally brain damaged.
c) emotionally disturbed.
d) educable mentally retarded.

A sample page of test items from an adjunct program to accompany Texas Education Agency's (1971) *Administrative Guide and Handbook for Special Education.*

Guidelines for the design of adjunct programs

☐ Analyze the contents of the chapter or the handout and identify important points to be emphasized.

☐ Write a series of multiple choice or true-false test items covering the essential content.

☐ Select an automatic scoring device. Use any device that will keep the correct choices unobtrusive until the teacher trainee makes a response, and then provide immediate feedback on whether the choice is correct or not. In addition to the punchboard previously described, a number of other automatic scoring devices are available, such as the following:

Tabsheets. The answer sheet has little tabs for each choice. The trainee removes the tab that corresponds to his choice to reveal the feedback.

Chemical cards. The box for the correct choice is printed with an invisible chemical. The trainee uses a special pen; the ink changes color if and only if he marks the correct choice.

Concealed-image response sheets. These use regular spirit masters. Marking the choice boxes with a special pen reveals the feedback message.

Teaching machines. Various inexpensive devices in which lights flash, buzzers sound, or bells ring when the correct choice slot is touched with a stylus.

With some of these devices (e.g., tabsheets and concealed-image response sheets) it is possible to provide page references for remedial instruction for all incorrect choices.

☐ Arrange the alternatives to each test item randomly, but make sure that the position of the correct choice corresponds to the answer pattern selected for the device. Failure to check this simple factor could be disastrous.

☐ Prepare a set of instructions on the use of the adjunct program. Stress the need for carefully reading the text, and explain the procedure for taking the test and obtaining feedback. Instructions should also indicate standards for acceptable performance (e.g., a 90% score) and explain the selective review and retest procedure if these standards are not met.

☐ Try out the adjunct program on a few teacher trainees, collect their response sheets (anonymously, if necessary), and conduct an item analysis. Identify ambiguous items in the test and rewrite them suitably.

An analysis may also reveal some items which are missed by trainees, not because of ambiguous wording, but because of insufficient coverage of the topic in the text. In this case, prepare supplementary instructional materials.

II. Repeated testing

This format is a combination of adjunct programing and the objectives-based resource list formats.

An example of repeated testing

Here is a description of a course in statistics required of special education students, and illustrated in the following flow chart, Figure 12.2. The student begins by taking an entry test. If he lacks the prerequisite arithmetic and algebraic competencies, he is asked to work on remedial materials and then to take the entry test again. Whenever he passes this test he is given a course manual that contains the specific behavioral objectives for various units, along with lists of suitable instructional materials keyed to these objectives. After working through the appropriate instructional materials, the teacher trainee takes a self-test and scores it himself. Both the test and the scoring key are also given in his manual. If he is not satisfied with his performance, he returns to his instructional materials or selects new ones and restudies the unit, paying special attention to those objectives he missed earlier. Whenever the teacher trainee feels that he has mastered the objectives for the unit, he reports to a testing center and takes the criterion test based on the same set of objectives. If he does not reach the criterion level (usually 90% or more) in this test, he is required to restudy the unit and take another parallel form of the test. If he fails the test for the third time, he meets a faculty member for a diagnostic interview. Any time he passes the criterion test, the teacher trainee proceeds to the next unit using the same procedure. After passing all criterion tests for the course, he receives his grade.

Design of materials for repeated testing

Most of the steps have been discussed earlier. For details of designing parallel forms of criterion tests, see Chapter 7. For information on locating and collecting various resource materials, refer to the discussion of guidelines for the design of resource lists keyed to instructional objectives in Chapter 10. One additional step is required: preparation of a course manual for the student-teachers.

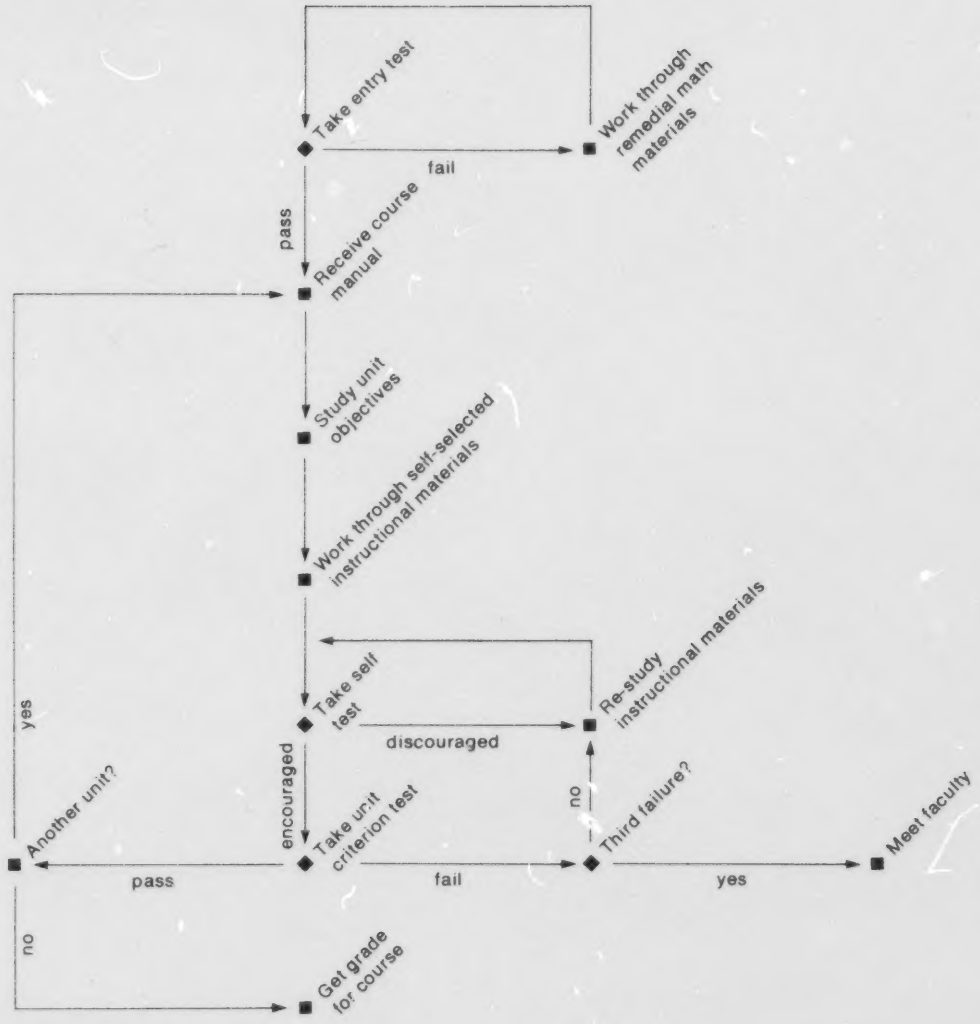


Figure 12.2
Flowchart illustrating mastery-learning through repeated testing format.

III. Personalized system of instruction

The main feature of this format is the use of advanced teacher trainees, that is, those who have successfully completed the unit, as student proctors for repeated testing, immediate scoring, and feedback. As in the previous format, the teacher trainee studies each unit on his own. Whenever he is ready for the unit test, he finds a student proctor to test him.

An example of personalized instruction (P.I.)

Ferster and Perrot's (1968) text *Behavior principles* is a fine example of the P.I. format. Each unit begins with a study guide containing a preview, rationale, list of technical terms, and an outline, and is followed by textual materials divided into logical parts. Each part concludes with a suggested set of interview questions. Testing is done in a one-to-one interview situation. Proctors are instructed to probe the trainees carefully for evidence of total mastery of all objectives. After being successfully interviewed on a unit, the teacher trainee proceeds to the next one and becomes qualified to interview and pass other trainees.

Most current versions of Personalized System of Instruction (PSI) replace interviews with more formal paper-and-pencil testing. They also utilize a variety of existing tests and instructional materials. A sample unit from Born (1970a) follows:

Unit 3
Methods of controlling behavior:
II. Decreasing the strength of behavior

Your reading assignment for this unit:
a. pp. 25-63 *The Analysis of Human Operant Behavior*
b. pp. 29-38 *Analysis of Behavior*

Your study questions for this unit are as follows:

1. What is *respondent extinction*? In the description of the case of Peter on page 25, the end of the first paragraph states that the bunny was removed after Peter ". . . once more burst into tears. . . ." If one is trying to eliminate crying in the presence of the rabbit, why might this not be a good idea? (Hint: Is crying a respondent or an operant?)
2. How does *operant extinction* resemble respondent extinction? What are some of the differences between extinction of *approach* behavior and extinction of *avoidance* behavior?
3. What is *satiation*? How has satiation been used to modify effectively instances of "misbehavior" in psychiatric patients?
4. What are the three major complications involved in the use of *punishment* as a technique for controlling behavior?
5. Specifically, what is *punishment*? How is punishment like reinforcement training? How is it different?
6. Cite two obvious reasons why most of the research on the effects of *response suppression* has been done with animals other than humans.
7. What is the effect of *mild shock intensity* on responding developed under VI schedules? What is the effect of intense shock? What usually happens to the rate of operant responding following the *withdrawal* of punishment?
8. What are the effects of *frequency of punishment* and *motivational* level on the rate of responding?

Sample materials from a study-guide; *Instructor manual for development of a personalized instruction course*, D. G. Born, 1970. Reprinted by permission.

Guidelines for the design of personalized system of instruction

The initial steps of task analysis, deriving objectives, arranging them into units, locating different instructional materials, and keying them to the objectives have been discussed earlier. Here are some additional steps:

☐ Devise a strategy for running the system. It should include procedures for recruiting, testing, and reinforcing proctors, guidelines for taking tests and retaking them, and policies for obtaining a final grade. It is essential to come up with a plan that can be transferred to other teacher-training institutions if the system is to receive wide dissemination.

☐ Write a manual for the teacher trainee. The introductory section should describe the policies and procedures for the course. Specific study guides for each unit should include objectives, reading lists and other instructional materials, a brief outline of the unit, supplementary readings, and a set of study questions.

☐ Write a manual for proctors. The following example shows the table of contents from Born's (1970b) *Proctor Manual* indicating the different topics to be discussed.

TABLE OF CONTENTS

I. INTRODUCTION
A. Your role in this course

II. PREPARATION FOR EXAMINATIONS

III. EVALUATING EXAMINATION PERFORMANCE
A. Greeting the Student
B. Teach, Don't Lecture
C. Initial Testing
D. Conditional Pass
E. Minor Mistakes
F. How to Fail Students

IV. STUDENT PROGRESS CHART

V. PROBLEM STUDENTS
A. Cheating
B. Procrastinators
C. Poor Students
D. Foreign Students
E. Belligerent Students

VI. COURSE WITHDRAWALS

VII. REPORTING INFORMATION ABOUT YOUR STUDENTS

VIII. PREPARING FOR PROCTOR MEETINGS

IX. CONCLUDING REMARKS

APPENDICES
A. Testing Guidelines, Procedures, and Record Books
B. Weekly Report of Student Progress
C. Instructor Duties: Monitoring Proctor Behavior

Table of contents from *Proctor Manual* (Born, D. C., 1970) indicating range of topics discussed. Reprinted by permission.

Selected bibliography on mastery-learning formats

Adjunct programing

Pressey, S. L. Development and appraisal of devices providing immediate automatic scoring of objective tests and concomitant self instruction. In A. A. Lumsdaine and R. Glaser (Eds.) *Teaching machines and programed learning: A source book*. Washington, D. C.: DAVI/NEA, 1960. (This sourcebook also contains other interesting articles on adjunct programing.)

Scoring devices

Instruction manual for the Rapid-Rater. Syosset, N. Y.: Research Media, Inc. 1964.

Manual of concealed image response techniques. Mount Vernon, N. Y.: Effective Learning Inc., 1972.

Repeated testing

Bloom, B. S., Hastings, J. T., & Mandaus, G. F. *Handbook of formative and summative evaluation of student learning*. N. Y.: McGraw-Hill, 1971. (Read especially Chapter 3 on learning for mastery and Chapter 6 on formative evaluation.)

Okey, J., & Ciesla, J. *Teaching for mastery*. Bloomington, Ind.: National Center for the Development of Training Materials in Teacher Education, Indiana University, 1972.

Personalized instruction

Personalized system of instruction: An alternative. Film, 16mm, black and white, 13½ minutes. Lincoln, Neb.: University of Nebraska Instructional Media Center, 1972.

Born, D. G. *Instructor manual for development of a personalized instruction course*. Salt Lake City, Utah: University of Utah, Center to Improve Learning and Instruction, 1970.

An excellent set of practical guidelines on the design of personalized systems of instruction.

Ferster, C. B., & Perrot, M. C. *Behavior principles*. N. Y.: Appleton-Century-Crofts, 1968.

A textbook based on the personalized instruction format.

Born, D. G. *Proctor manual*. Salt Lake City, Utah: University of Utah, Center to Improve Learning and Instruction, 1970.

A good example of a proctor's manual.

Chapter 13
Self-instructional print formats

Objectives

1. Give examples of the self-instructional print format and list their common features.
2. Prepare a handout on a suitable instructional topic using appropriate instructional design features.
3. Prepare different types of information maps related to a suitable instructional topic.
4. Develop a programed instructional module on a suitable instructional topic.

The three formats described in this chapter consist of printed materials designed for use by individual teacher trainees. The major difference among the formats is in the amount of control exerted over the trainee's study behavior. The first format is the traditional textbook, which continues to be one of the most effective and flexible instructional formats, but which does not exert too much control over the reader's behavior. The second format, instructional mapping, is still evolving as a technique for efficient organization of instructional information for both initial learning and quick reference. It uses a tightly structured format but allows the teacher trainee considerable freedom. The third format, programed instruction, requires active involvement of the teacher trainee and controls the sequence and the method by which he learns.

I. Textbooks and directives

In spite of its obvious limitations, the textbook can be considerably improved through the application of systematic instructional-development processes. Although few readers may be planning to write an entire text in the near future, the same approaches are useful for preparing directives.

One of the major student complaints about textbooks is their lack of relevance to classroom problems. Texts could be made more relevant if they began with analyses of the teacher's tasks and the concepts related to the teaching of exceptional children. A number of effective elements from other instructional formats can be adapted for use with textbooks and directives. For example, each chapter of the text could begin with a set of objectives and end with criterion-referenced test questions.

The instructor's guide to the textbook could suggest various innovative management formats. Texts are easily adaptable for use with personalized systems of instruction and mastery-learning formats.

Textbook writers, by reputation, are verbose and formal, perhaps because the skill and innovation required to write a succinct text in the target-trainee's language are not easy to acquire. Fortunately, most current textbook authors are discarding the traditional approach and talking directly to the teacher trainees. Textbooks and directives can also be made more efficient through the use of a number of learning aids: charts and tables, summaries, expanded tables of contents, headings and subheadings, typographical cues, illustrations with explicit captions, references and bibliographies, glossaries, and indexes.

Textbooks and directives should be tried out and revised just as any other instructional material. A teacher trainer may start with a series of directives for his course and request the trainees to make comments and suggestions on their copies and then to exchange them for clean ones at the end of the semester. After suitable revisions, the new version can be tried out on the next class. When trainee feedback becomes consistently positive, the materials can be assembled as a textbook for final publication. Some useful guidelines on textbook publication and effective writings are listed in the selected bibliography at the end of this chapter.

II. Information mapping

Information mapping is a new and still-evolving format for the design of printed instructional materials. It is especially applicable to the preparation of teacher-training handouts in special education. In this technique, units of instructional content are classified into concepts, structures, processes, procedures, classifications, facts, or proofs. Each type of content has a standardized presentation format called a map. A map is made up of different units called blocks. The following example of a concept map includes the name of the concept, an introduction, three examples, a definition, two nonexamples, a notation, and related map blocks. A procedure map, to give another example, has the name of the procedure, procedure table, flowchart, occasion for starting, when to stop, decision table, checklist, and worksheet blocks. Rules for writing the blocks and assembling them into maps are based on principles of instructional design and learning theory. Single maps may be used as directives. For larger sections, the maps are assembled into units and the units into courses. Other unique features of the information-mapping format include marginal labels, uniformity of headings and subheadings, local indexes in each map, and feedback questions.

Introduction	Now that we understand the nature of a concept, we are ready to deal with those cognitive demands which require the learner to relate two concepts.
Example one	Teacher: Meredith, what is the difference between a square and a rectangle?
Example two	Teacher: Lynn, could you tell me how a square and a rectangle are alike?
Example three	Teacher: To find the area of a square all we do is to take the length of a side and multiply it by itself. Karin, what is the area of a square whose side is 10 feet long?
Definition	An applying-comparing cognitive demand involves rules and concepts. It may take any one of these forms: • comparing different concepts • contrasting different concepts • explanation of how rules apply to concepts • application of a rule
Nonexample	Teacher: Renie, could you tell me the difference between this bottle and the one on the table? This is not an applying-comparing demand since actual objects (not concepts) are being compared.
Nonexample two	Teacher: If you were trapped in the middle of a tropical forest, what would you do, Mike? This goes beyond direct application of a single rule but rather is a whole problem-solving situation.
Notation	In the Individual Cognitive Demand Schedule, applying-comparing demands are coded as AC.
Related maps	The following related maps deal with other categories which involve concepts and/or rules: defining-classifying, 32 inferring, 58 problem solving, 64

An example of a concept map, based on Lynch and Ames (1971), *Individual cognitive demand schedule.*

Guidelines for the design of information-mapped materials

An outline for designing information maps follows. More detailed procedures can be found in Horn, Nicol, Raxar, and Kleinman (1971).

☐ Divide the lesson content into different units. Classify the type of information for each unit into one of the seven categories of information maps.

☐ Write suitable information maps for each unit. Use graphic aids (tree diagrams, comparison and contrast tables, summary tables, prerequisite charts) to present the information with maximum clarity.

☐ Arrange information maps into a unit. Interrelate them through cross references.

☐ Design suitable feedback questions and place them in appropriate locations.

III. Programed instruction

Some educators have written off programed instruction as a viable instructional format at the level of teacher training; others are excitedly reinventing it. Programed instruction has come a long way from small-step frames and zebra-striped books and it has an important role in the training of special education teachers. It is especially suited for instruction in fundamental skills and knowledge. However, exclusive use of programed instruction over long periods of time is not recommended.

Examples

The succeeding examples are pages from two different programed instruction manuals. The teacher-trainee goes through various frames of the program that present segments of information. Each frame also poses a question and requires the learner to respond actively to it. Only after making his response does the teacher trainee look at the correct response given in the program. Later frames present additional new information, relate it to the information previously learned, and lead the trainee toward the mastery of all objectives.

This type of programed instructional material is generally labeled "linear." In another type called "branching," the teacher trainee is referred to different frames, depending upon his choice of answer to the question in each frame. In the new frame, following a correct choice, he is complimented and presented with the next piece of information and a new question. Following an incorrect choice, he is sent to a remedial frame that explains his error and then back to the original frame for another try at answering the question.

A sample page from a self-instructional program; Harless, J. H., and Lineberry, C.S. *Turning kids on and off* (1971). Reprinted by permission.

Part III: Contingency management, a motivational system

As you drive through the community on your way home after school, or on a Saturday morning, you observe your students engaged in a variety of leisure-time activities. Some are playing ball on the corner lot, some are bicycling, a group has gathered in front of the ice cream shop to talk, another group is busy working on their cars at the gas station. Others are to be found working part-time jobs, reading comic books in the drug store, or "just hanging around." What accounts for different students engaging in varying leisure-time activities?

1. Kids are easily bored and move from one activity to another. □
2. The activities described are all enjoyable to kids □
3. When given a choice, kids would rather do some things than others. □

The point is so obvious that you probably never bothered to recognize it. Given a choice, kids would *rather do some things than others*. No. 1 is true, as we shall see; their preference in activities changes. No. 2 is inaccurate because it rules out individual preference. The boys working on their cars may consider the baseball game on the corner lot distinctly unpleasant, and vice versa.

So what?

Let's focus on one student. It's midmorning, Saturday, and as you drive to the shopping center, you notice Jeff hard at work mowing the lawn. Select the hypothesis that you think best accounts for Jeff's behavior.

1. Jeff is mowing the lawn because he enjoys it. □
2. Jeff is mowing the lawn because he is bored. □
3. Jeff is mowing the lawn because his father told him if he did, he could use the car for his date that night. □

While some boys probably do enjoy lawn-mowing on Saturday morning, they probably represent a minority. If Jeff were bored, he would probably seek an environment where activities more in line with his preference were available. No. 3 is the most logical of the hypotheses presented. If Jeff mows the lawn, then he may use the car for his date that night.

That's Contingency Management

A sample page from a programed manual, *Modifying classroom behavior*, Buckley, N. K., and Walker, H. M., 1970. Reprinted by permission.

1. Research studies by Eysenck (1952, 1960) and Levitt (1957, 1963) have shown that traditional methods of psychotherapy are no more effective than the passage of _____ in producing behavior _____ — Time change

2. Behavior change is defined as an *observable* alteration in overt behavior. A shift in a child's emotional state (would, would not) be defined as behavior change. — would not

3. Behavior change is not represented in the example (in #2) above because there was a shift in the child's _____ state which (is, is not) an observable change in _____ behavior. — emotional; is not; overt

4. Research studies have demonstrated that while internal feeling states exercise control over some human activities, they are not _____ predictors of changes in overt behavior. — effective; reliable, good (or) valid

5. Conversely, research has shown that environmental events such as reinforcing and aversive stimuli exercise powerful _____ over overt behavior. — control

Guidelines for the design of programed instructional materials

Assuming that you have derived a set of specific behavioral objectives, here is an outline for designing a self-instructional program:

☐ Write a criterion frame to check the attainment of each specific instructional objective. Arrange the criterion frames in a sequence suitable to forming an outline for the program.

☐ Write a series of teaching frames to lead the teacher trainee from his entry behavior to the performance required in the first criterion frame. Close the gap between this criterion frame and the next one with another sequence of teaching frames. Continue this procedure until you have enough sequences of teaching frames to enable the teacher trainee to respond correctly to all criterion frames.

☐ A teaching frame should be relevant to the next criterion frame. It usually presents some information and asks a question based on it. The question should be worded in such a way that the correct response requires more thought than merely copying the information. It should be a critical question that forces the teacher trainee to attend to all important elements of the information and to process them mentally before coming up with the answer.

☐ The initial version of the program should be kept lean by using just the minimum estimated number of teaching frames. This practice enables us to find the need for additional frames during tryouts—a task easier than that of locating excess frames.

Selected bibliography on self-instructional print formats

Textbooks and Directives

Author's guide. Worthington, Ohio: Charles A. Jones, 1955.

Gilbert, M. B. *Clear writing*. N. Y.: John Wiley, 1972.

Tichy, H. J. *Effective writing*. N. Y.: John Wiley, 1967.

Information mapping

Horn, R. E., Nicol, E. H., Raxar, M., & Kleinman, J. C. *A reference collection of rules and guidelines for writing information mapped materials*. Cambridge, Mass.: Information Resources, 1971.

Programing

Bullock, D. H., & Wilson, W. *Creating programs for self-instruction*. Washington, D.C.: Center for Educational Technology, Catholic University of America, 1972.

Bullock, D. H., & Wilson, V. *Editing and revising programs for self-instruction*. Washington, D.C.: Center for Educational Technology, Catholic University of America, 1972.

Markle, S. M. *Good frames and bad: A grammar of frame writing* (2nd ed.). N. Y.: John Wiley, 1964.

Pipe, P. *Practical programming*. N. Y.: Holt, 1966.

Thiagarajan, S. *The programming process: A practical guide*. Worthington, Ohio: Charles A. Jones, 1971.

Chapter 14
Self-instructional multimedia formats

Objectives

1. Give examples of self-instructional multimedia materials in teacher training and list important features of this format.
2. Design an audiotutorial module on a suitable instructional topic.
3. Design a multimedia module on a suitable instructional task.
4. Design a minicourse on a suitable instructional task.

Three self-instructional formats that depend primarily upon non-print media are described and discussed in this chapter. Audiotutorial modules use audio tape to guide the trainee's interaction with instructional materials. Multimedia modules present instruction through both visuals (slide, filmstrip, or transparency) and audio tape. Minicourses use film and video tape to involve the trainee in observing a model lesson, teaching, self-evaluation, re-teaching, and re-evaluation.

I. Audiotutorial modules

Originally conceived of by Postelthwait and his associates (1969) for undergraduate biology courses, the audiotutorial format has since been used in a variety of situations, including the training of special education teachers. The format (or its minor variants) is also known by such labels as modular instruction and minicourse. The term "audiotutorial" clearly indicates the major feature of this format: a one-to-one tutorial approach in which audio tape is the integrating element.

An example of an audiotutorial module

An audiotutorial module on instructional games for handicapped children, developed at the Center for Innovation in Teaching the Handicapped, serves as our example. The trainee sits in a carrel and turns on a tape recorder. The module begins with an audio taped welcome followed by information on various instructional materials in the carrel. Then the tape invites the trainee to inspect a study guide containing diagrams, directions for various activities, a glossary, and a list of references on instructional

games. When the narrator provides a rationale for the use of the games with mentally retarded children, he directs the teacher trainee to turn on a slide projector and view a group of handicapped children learning from a game. He outlines a procedure for developing learning games. The trainee has an actual game board in the carrel and is given a step-by-step description of its development. This description is illustrated with slides. The steps in game development are also listed in the study guide. Then the trainee is asked to leave the carrel and to develop his own learning game. When he returns with a prototype of a game, the tape narrator asks a series of evaluation questions and suggests various ways in which potential problems can be eliminated. An explanation is given of how a game is tried out with children and the procedure is illustrated on slides. The trainee leaves the audiotutorial module ready to modify his game and test it with children. He takes his study guide with him as a reference source since it contains his notes in addition to the various checklists.

Guidelines for the design of audiotutorial modules

☐ With an approximate idea of the objectives, write a rough script for the audio tape. Let other trainers go through the script to check its relevance and accuracy.

☐ Analyze the content of the script to derive revised objectives for instruction. Construct a criterion-referenced test based on these objectives.

☐ Select suitable instructional media and activities. The media may include real objects, models, slides, film loops, printed pictures, and text. The activities can include listening to the tape, reading the guide, completing assignments, examining specimens, and solving problems.

☐ Plan a tentative sequence of instructional content and activities.

☐ Collect such existing materials as film loops, real objects, and booklets. Prepare additional materials as required. Also prepare a rough draft of the study guide for the teacher trainee. This booklet should include all photographs, diagrams, tables, and checklists and it should provide space for note-taking.

☐ With a tape recorder, instructional materials, study guide, and the objectives in front of you, prepare a rough tape. Remember that the trainee must be actively involved all the time. Take an imaginary student through the module or work with an actual teacher trainee.

☐ Transcribe the rough tape and edit it. With the edited transcript and instructional materials, prepare a revised tape. Retape and transcribe the module using a professional voice if necessary. Also prepare multiple copies of the study guide.

☐ Set up the completed audiotutorial module in a carrel for evaluation by subject-matter experts, editors, and trainees. Modify the module on the basis of their comments and suggestions.

Suggestion for further reading

Postelthwait, S. N., Novak, J., & Murray, H. T. *The audiotutorial approach to learning*. Minneapolis, Minn.; Burgess Publishing Co., 1969.

II. Multimedia modules

Multimedia modules use projected visuals (slide, transparency, or filmstrip) and audio tape. Many media-equipment manufacturers now sell compact units which have a small television screen and which automatically synchronize a slide (or filmstrip) and cassette tape. Although these devices are very useful in a learning carrel, any regular projector and tape recorder combination can be used.

Guidelines for the design of multimedia modules

Prepare an outline of specific instructional objectives for the module. Select suitable media for each unit of instruction based upon these objectives and learner analysis. For details of media selection, see Chapter 8.

☐ Prepare an outline for the module, indicating the visual or auditory mode for different sections of the materials. Check this outline for any interfering combinations.

☐ Design visual and auditory messages to take the fullest advantage of the intrinsic qualities of the media. For example, it is better to record spontaneous oral instructions to a trainee from an actual encounter than to use a written script.

☐ Involve teacher trainees in the testing of the modules as early as possible. Test visuals to see if they clearly present the message. Add captions and auditory narration as needed. Use less expensive media to simulate the final product during initial stages of tryout and revision, that is, paper visuals instead of slides or video tape instead of film. Try out each component separately. After preliminary modification, test the combination to make sure all components are smoothly integrated.

Suggestions for Further Reading

Briggs, L. J., Campeau, P. L., Gagne, R. M., & May, M. A. *Instructional media: A procedure for the design of multi-media instruction, a critical review of research and suggestions for future research*. Pittsburgh: American Institute for Research, 1967.

Langdon, D. G. Media messages on their own terms. *Educational Technology*, 1972, **12**, 39-42.

III. Minicourses

Minicourse is the name given to a teacher-training material format developed by Borg (1970a) and his associates around the microteaching technique. A number of successfully tested minicourses are available for inservice and preservice teacher training. Although none is specifically designed for use with teachers of handicapped children, many of them deal with generic teaching skills which can be applied to any teaching situation. The format itself has great potential for the development of special education teacher-training materials, particularly when the instructional task involves specific classroom teaching skills.

An example of a minicourse

Minicourse 1 (Borg, 1970a) is devoted to the development of effective questioning skills in classroom discussion. Its first component is an introductory film that serves as a motivating device and specifies the instructional objectives in terms of skills to be learned. An instructional film presents segments of the particular skills being used in a classroom situation. A model film shows a teacher using these skills in a brief lesson involving a few pupils (a microteaching situation). This film provides a clear model of the application of the skills and requires the student to identify those skills as they occur in later segments. The film also provides immediate feedback for this discrimination training. The teacher trainee evaluates the model lesson with a form from the *Teachers' Handbook*.

The trainee next plans a 10-minute lesson using special forms in the *Handbook*. He teachers the lesson to a small group of learners, and incorporates the skills he learned. This lesson is recorded on video tape and replayed immediately upon completion. The trainee now undertakes self-evaluation, using microteaching evaluation forms, and he pays special attention to the frequency and quality of the skills taught in the package. Based on this self-evaluation, the trainee reteaches the lesson to another group of pupils. The re-taught lesson is also recorded on video tape and subjected to another self-evaluation.

After completing this sequence, the trainee undertakes a systematic set of follow-up activities in his classroom to help him review and improve his on-the-job skills.

Guidelines for the design of minicourses

The guidelines for the development of minicourses shown on page 111, are reprinted from *The minicourse: a microteaching approach to teacher education* (Borg et al., 1970).

Suggestions for further reading

Borg, W. R. Guidelines for the development of minicourses. Berkeley, Calif.: Far West Laboratory for Educational Research and Development, ERIC document number ED 053 091 (n.d.).

Borg, W. R., Kelley, M. L., Langer, P. & Gall, M. *The minicourse: a microteaching approach to teacher education.* Beverly Hills, Calif.: Macmillan, 1970.

The Major Steps in the Development Cycle

1. Research and Data Gathering	Includes review of literature, classroom observations, and preparation of report on the state of the art.
2. Planning	Includes definition of skills, statement of objectives, determination of course sequence, and small-scale feasibility testing.
3. Developing Preliminary Form of Product	Includes preparation of instructional and model lessons, handbooks, and evaluation devices.
4. Preliminary Field Test	Conducted by Laboratory personnel in one, two, or three schools, using between six and twelve teachers. Includes collection and analysis of interview, observational, and questionnaire data.
5. Main Product Revision	Revision of product as suggested by preliminary field test results.
6. Main Field Test	Conducted by Laboratory personnel in between five and fifteen schools using between thirty and one hundred teachers. Includes collection of quantitative data on teachers' pre- and post-course performances, usually in the form of classroom videotapes. Results are compared with course objectives.
7. Operational Product Revision	Revision of product as suggested by the main field test results.
8. Operational Field Test	Conducted by regular school personnel in between ten and thirty schools, using between forty and two hundred teachers. Includes collection and analysis of interview, observation, and questionnaire data.
9. Final Product Revision	Revision of product as suggested by operational field test results.
10. Dissemination and Distribution	Reports at professional meetings, in journals, etc. Includes work with publisher who assumes commercial distribution, and monitoring of distribution to provide quality control.

Guidelines for the design of minicourses. Borg, W. R., Kelley, M. L., Langer, P., & Gall, M. *The minicourse: a microteaching approach to teacher education.* Beverly Hills, Calif.: Macmillan, 1970. p. 54. Reprinted by permission.

Chapter 15
Formats for small-group learning

Objectives

1. Give examples of teacher-training materials which are used by small groups and list the important features of this format.
2. Design a roleplay exercise on a suitable instructional topic.
3. Design an instructional game on a suitable instructional topic.
4. Design a simulation on a suitable instructional topic.

The formats described in this chapter are designed for use by small groups of teacher trainees. Their instructional effectiveness depends upon interactions and discussions among the members of the group. Although few of these formats have been used extensi ely in the training of teachers of exceptional children, their potential is great.

I. Roleplay

Roleplay is an effective technique for actively involving teacher trainees in the dramatization of different interactions between themselves and the exceptional child, parent, or administrator. Through roleplay, trainees may acquire appropriate interpersonal skills, teaching techniques, empathy, and flexibility. Roleplay formats range widely, from psychodrama to charades.

An example of roleplay

A simulation program for training teachers in behavior management (Fink, Briggs, & Thiagarajan, 1972) uses a number of roleplay exercises. Each session involves a small group of five teacher trainees and each is programed by an audio tape and a booklet. In a typical segment, a few warmup exercises are followed by the assignment of roles. The participant with the role of the teacher picks up a card with these instructions:

This session is on the use of demeaning criticism.

Demeaning criticism is the psychological degradation of pupils with verbal attack, criticism or sarcasm, e.g., "I suppose you think you are being clever."

Teach a simple elementary-school lesson of your own choice. When your pupils misbehave, get angry; be nasty and critical; be sarcastic and insulting; don't let them get the better of you.

Use demeaning criticism as many times as possible.

The card to the player with the role of a "deviant" pupil has these directions:

Misbehave frequently during this session.

During the five-minute period change over from being mildly disruptive to being insulting, aggressive and abusive. Make the teacher get mad at you.

Another trainee plays the role of a "good" pupil. The remaining two trainees act as observers and take notes on the players' behaviors.

Each roleplay session lasts five minutes. Roles are changed for each session so that all participants play all roles. After roleplaying, the feelings and emotions that accompany the use of a specific control technique are discussed. The total package takes about 20 hours and covers different behavior control techniques and their emotional consequences.

Guidelines for the design of roleplay exercises

Roleplay exercises of this type have two components: content and operation. The former reflects the learning task and the latter controls the mechanics of assigning roles and scheduling the sessions. It is useful to put the content on separate cards or in a booklet and the operations on audio tape. The tape recording also serves as a timing device.

☐ Design a set of roleplay exercises that involve the affective aspects of your task analysis. These exercises should revolve around critical situations in the everyday life of a teacher of exceptional children. Have them edited by other teachers for authenticity and clarity. The final version of each exercise should contain a description of the teaching situation, elements of interpersonal confrontation, and specific directions for the teacher and the pupils.

☐ List a set of open-ended questions for discussion after the roleplay sessions. These questions should be based upon the aspects of the roleplay which are of instructional importance.

☐ Work out the mechanics of assigning roles and scheduling sessions. Prepare an audio tape recording to coordinate the roleplay. This tape assigns and reassigns different roles to different members of the group, refers them to appropriate sources for instruction, maintains time limits, and provides necessary cues.

☐ Test the roleplay exercises with teacher trainees. Organize a small roleplay group and have them work through the material. Evaluate the clarity of instructions and suitability of session length. Monitor the post-roleplay discussion for suggestions on useful questions to be included in the discussion.

☐ Modify the package on the basis of the feedback from the tryout. Retest the materials until your instructional objectives are consistently attained.

Suggestions for further reading

Chesler, M., & Fox, R. *Roleplaying methods in the classroom.* Chicago: Science Research Associates, 1966.

Lehman, D. L. *Roleplaying and teacher education: A manual for developing innovative teachers.* Washington, D. C.: The Commission on Undergraduate Education in the Biological Sciences, 1971.

II. Instructional games

Instructional games are effective for both low- and high-level cognitive learning: They add motivation to the former and provide realistic structure for the latter. Games also enhance the attainment of attitudinal objectives. The use of instructional games in the preparation of teachers for exceptional children has yet to receive the attention it deserves.

An example of an instructional game

A series of table games called ANTICIPATION (Semmel, 1971) assists teacher trainees to induce generalizations about the behaviors of different types of mentally handicapped children in varied situations. The first game in this series is played by two opposing teams using question cards such as the examples on the following page.

One side of the card contains a question as it is presented to the children, the other side contains a table of percentages of correct responses by children grouped by age and IQ level. The tables are based on empirically derived normative data (Meyen & Hieronymus, 1970). The questions cover the areas of language, arithmetic, and work/study skills. The first team chooses a card, reads the question, and estimates the percentage of children of a specific age and IQ group (e.g., 12-year-old low educables) who would probably give the correct response to that question. The opposing team has the option of challenging this estimate. Whichever team is closer to the actual percentage on the table wins the round and places a counter on a tic-tac-toe grid. The goal of the game is to get three counters of the same team in a straight line.

During this and other ANTICIPATION games, players are exposed to regular patterns of behavior; they make up their own generalizations, discuss them with their teammates, test them against the data, and revise them on the basis of feedback.

Language Skills: Spelling

Find the spelling mistake.

1) sixty
2) twelve
3) dosen
4) quarter

Age	9	10	11	12	13	14
EMR Group	19	31	29	43	56	57
50-65 IQ Group	6	22	21	37	53	32
66-80 IQ Group	23	34	32	45	57	66
Normal Group	81	87	98	98	95	98

Question cards used in ANTICIPATION games. Top figure shows the front of the card with the question. Back of the card (lower figure) has a table of percentages of children (grouped by age and IQ levels) responding correctly to the question.

Guidelines for the design of learning games

Figure 15.1 outlines the steps in the production of an instructional game.

☐ Step 1. **Conduct a task analysis.**

☐ Step 2. **Conduct a learner analysis.**

☐ Step 3. **Select a suitable game format.** A number of classical game formats are effective for attaining different types of objectives. An objective that requires classification of objects, for example, suggests the format of the card game "rummy." In the ANTICIPATION games described above, curricular areas interacting with three IQ levels suggested the tic-tac-toe grid.

☐ Step 4. **Design basic rules.** The instructional objective is now translated into the criterion for winning the game. For example, the objective for one of the ANTICIPATION games is for the teacher trainee to demonstrate an understanding of chronological development in arithmetic operations. To win this game, the player must make accurate estimates of the performances of children at different age levels in arithmetic tasks. Based on this principal rule for winning the game, the detailed playing procedure is worked out in terms of a set of necessary and sufficient rules.

☐ Step 5. **Design game equipment.** Rules of play suggest various game equipment and materials. Equipment for ANTICIPATION games includes a game board with a 3x3 grid, question cards, counters of two different colors, and score pads.

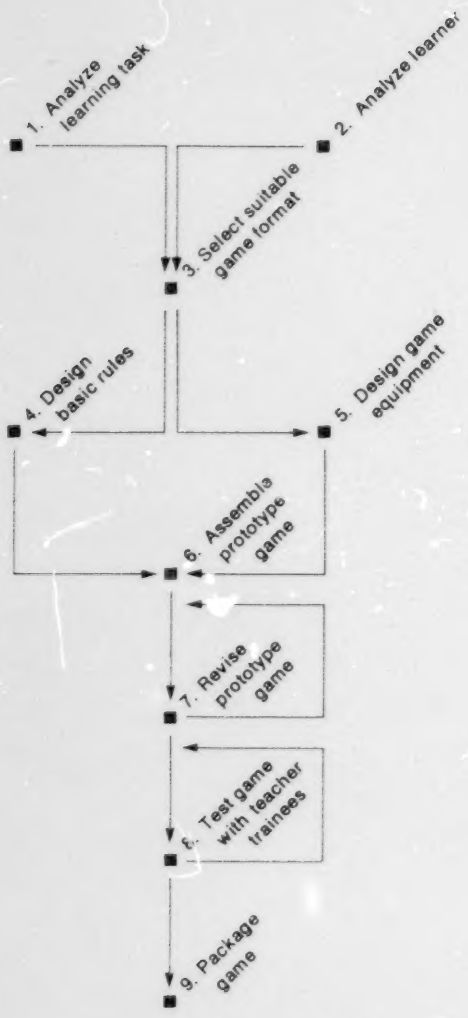

1. Analyze learning task
2. Analyze learner
3. Select suitable game format
4. Design basic rules
5. Design game equipment
6. Assemble prototype game
7. Revise prototype game
8. Test game with teacher trainees
9. Package game

Figure 15.1.
Steps in the production of an instructional game.

☐ Step 6. **Assemble prototype game.** All the equipment is now prepared and the rulebook written.

☐ Step 7. **Revise prototype game.** Although the final judges of a game are its players, a number of game-design rules are available to help locate potential problems and eliminate them. Checklist 15.1 lists some important suggestions.

☐ Step 8. **Test game with teacher trainees.** The next step is the actual tryout of the game. Begin by playing the game with a small group of teacher trainees. Obtain feedback by watching the players' reactions and noting their spontaneous comments and suggestions. Hold a "debriefing" session after the game to check the motivational and instructional effectiveness of the game. The game should be revised to strike a balance between interest and instruction. This process may require modifications in both the rules and the equipment.

☐ Step 9. **Package the game.** During this final step, the instructional game is prepared for distribution. All required equipment and materials shoud be conveniently arranged in a box, including an instruction manual to teach the mechanics and the strategy of the game.

Checklist 15.1
Revising Rules of Instructional Games

Make sure that the scoring system of the game is clearly related to its instructional objectives.

Control the element of chance. If the game depends entirely upon the fall of cards or throw of dice, not much scope is given for learning. On the other hand, if the game depends upon skill and knowledge only, it becomes a test situation.

Make the rules of play fair. Do not give any player an undue advantage. Permit fair competition between players of varying abilities with some handicapping arrangements.

Keep all players involved all the time. During each round of the game, require all players to participate. Avoid rules that eliminate a player from the game as a penalty.

Keep each round of the game as brief as possible. This principle permits the game to be played repeatedly within a short period of time.

Simplify the rules of the game as much as possible. Avoid irrelevant embellishments.

Suggestions for further reading

Two useful books on instructional games:

Abt, C. *Serious games*. N. Y.: Viking Press, 1970.

Gordon, A. K. *Games for growth*. Chicago: Science Research Associates, 1971.

A "how-to" article on instructional games:

Thiagarajan, S. Design, development and validation of instructional games. *Improving Human Performance: A Research Quarterly*, 1971, **10**(10).

A simulation game on the design of games:

Thiagarajan, S. *The GAMEgame*. Bloomington, Ind.: Center for Innovation in Teaching the Handicapped, Indiana University, 1972.

III. Simulations

Simulations create situations that are analogous to certain aspects of reality. They require the teacher trainee to behave realistically in those situations and they provide him with feedback that reflects real-life consequences. However, simulations differ from reality in two important aspects: They are largely replicable and the amount of risk involved is negligible. In the training of teachers, simulation may be used both for instruction and for evaluation. Simulations act as a bridge between methods courses and the real classroom. They are especially useful when the instructional objectives are attitudinal or emotional.

An example of simulation

Broadbent and Meehan (1971) described a simulation workshop of approximately six hours' duration. The target trainees were inservice teachers from regular classrooms. The objective of the simulation was to increase their awareness of different types of learning disabilities, willingness to seek ancillary help, and motivation to initiate remedial programs in the classroom. The participants assumed the role of a third-grade teacher who is reflecting upon the events of the first half of the school year. Each participant was provided with a folder containing the class pictures of 24 children, class list, achievement test scores, reading levels, IQ scores, and teacher comments. In the class were eight children with learning problems resulting from the lack of sequential instruction or the presence of slow-learner characteristics, hyperactivity, auditory perception, visual-motor factors, visual-perceptual factors, emotional handicaps, or cultural factors. The

object of the simulated exercise was for the teachers to identify the youngsters with learning disabilities.

The players watched a video tape to become familiar with the children. They were required to identify and list those with possible learning problems and they were encouraged to compare notes with each other and to discuss various clues indicating such problems. At the end of this stage, additional information on the eight children was distributed in the form of cumulative record folders and students' work. The participants were allowed to ask for and receive additional information from whatever source. They also "administered" an informal test—the *Purdue Perceptual-Motor Survey*. A video tape indicated how the children performed on the individual tasks of the test. Through this step-by-step process, the teachers identified the children with learning difficulties and planned suitable remedial programs.

Designing simulation materials

Many of the guidelines for the design of roleplay materials and instructional games will be found equally applicable to the design of simulation materials. At the heart of the simulation is the real life situation or, as Twelker (1969) pointed out, the model or theory of reality that is being simulated. The following aspects of reality suggest different components of a simulation exercise.

Context. All simulations take place in a specific context. In the given example, it is a third-grade classroom. In another situation, it could be a special school. One of the essential components of a simulation package is information on the context. It can be provided by giving each player a printed scenario indicating where the action takes place. Specially designed protocol materials (similar to the video tapes in the sample simulation) are also useful for setting the stage for simulation.

Content. Simulation materials usually concentrate on one aspect of the context. In this example it is the identification of children with learning disabilities. In another context, it could be the allocation of funds for the gifted during a budget meeting. It is essential that the important elements of the limited problem being simulated be clearly identified and communicated to the participants, such as specifying the resources with which, and the constraints under which, the participants are to act.

People. Another important aspect in a simulation is the roles of the people who must interact with each other. For example, they can include the teacher, children, school psychologist, and administrator. In a full-blown simulation, different participants may play different roles. Since the objectives for each actor often differ from those of others, the strivings of each person to attain his goal may generate conflict with the perceived goals of other players.

Designing an effective simulation package requires the clear specification of these elements. Most simulations can be cast in the form of games. As in the case of instructional games, tryout and modification are essential developmental steps.

Suggestions for further reading

Adair, C. H., & Foster, J. T. *A guide for simulation design*. Tallahassee, Fla.: Instructional Simulation Design, 1972.

Boocock, S. S., & Schild, E. O. (Eds.) *Simulation games in learning*. Beverly Hills, Calif.: Sage Publications, 1968.

Twelker, P. A. Designing simulation systems. *Educational technology*, 1972, **9**, 64-69.

Twelker, P. A., Urbach, F. C., & Buck, J. E. *The systematic development of instruction: An overview and basic guide to the literature*. Stanford, ERIC Clearinghouse on Media and Technology, Stanford University, March 1972.

Twelker, P. A. *Instructional simulation systems: An annotated bibliography*. Corvallis, Oregon, Oregon State University, Continuing Education Publications, 1969.

Zuckerman, D. W., & Horn, R. E. *The guide to simulation games for education and training*. Cambridge, Mass.: Information Resources, 1970.

Chapter 16
Computer-based formats

Objectives

1. Give examples of computer-assisted teacher training materials in special education and list important features of this format.
2. Describe the computer-assisted remedial education (CARE) program and indicate its potential applications to other topics in training teachers of exceptional children.
3. Describe the computer-administered repeated testing (CART) program and indicate its potential application in training teachers of exceptional children.
4. Describe the computer-assisted teacher training system (CATTS) and indicate its potential application in training teachers of exceptional children.

Because of the extraordinary cost and technical resources required, few special education teacher trainers will undertake the design of computer-assisted instruction (CAI) materials. However, as CAI systems have great instructional potential, three computer-based formats currently in use for training teachers of exceptional children are described. Each is a computerized version of a nonautomated instructional format: programed instruction, mastery learning, and field training.

Examples of computer-based formats

I. Computer-assisted remedial education (CARE)

This package, developed at Pennsylvania State University (Cartwright & Mitzel, 1971), deals with the identification of handicapping conditions in children. Visual information is presented through a cathode-ray screen and an image projector, and auditory information is presented through a four-channel, audio tape recorder. The trainee is required to make frequent responses as he works through the course. To respond to multiple-choice questions, he uses a light pen to touch his choice on the screen; for other questions, he uses an electric typewriter. In either case, the computer processes his response and comes up with appropriate feedback within a matter of milliseconds.

The computer provides instruction in either *tutorial* or *inquiry-and-simulation* modes. In the first case, the teacher trainee is presented with frames like those of programed instructional materials. Based upon his response to each frame, he is given either regular, remedial, or enrichment material.

With the sophistication of the computer, extremely versatile branching and individually tailored instruction become possible. In the inquiry-and-simulation mode, the trainee applies his skills to identifying children with actual or potential handicaps in a simulated first-grade classroom. He has access to the children's cumulative-record folders and he may ask the computer for additional information. Frequently, the computer provides false leads; however, it explains the inappropriateness of a particular line of questioning before the trainee is led astray.

Upon the completion of the course, the teacher trainee not only acquires diagnostic skills and concepts but he also learns to apply them in the construction of case histories and to plan alternative instructional strategies for different children.

II. Computer-administered repeated testing (CART)

One of the major tasks in the mastery-learning format is to develop different versions of the same criterion test along with an answer key for each version. In many subject-matter areas this task could be entrusted to a computer using either of the following two techniques:

1. A large pool of objective items is constructed and organized according to the objectives they measure. The computer is programed to select randomly an item for each objective and to print it out whenever a new version of the test is needed. It can also print out an answer key for use by the trainee or the student proctor.
2. In areas where computational skills are involved, the basic form of the question is fed into the computer for random printout at appropriate places. The computer may also be programed to print out the correct response for the trainee or his proctor for evaluation purposes. Along with the answers, the computer can also print out the permissible range of error (e.g., "The correct response is 13.79, any response within .50 of this figure is acceptable") and intermediate steps.

III. Computer-assisted teacher training System (CATTS)

A direct and effective method of training a potential teacher is through practice teaching. Usually, however, feedback given to the trainee in a supervisory conference is based on vague, *ad hoc* impressions. Objective, reliable feedback on teaching behavior can be obtained and transmitted through a teaching observation system that categorizes and operationalizes the behaviors which are deemed relevant by the trainee and his supervisor. This objective technique, however, requires tedious data analysis and incurs a delay in the feedback.

The Computer-Assisted Teacher Training System (CATTS) developed by Semmel and his associates (1972) minimizes the problems inherent in conventional observation-coding-feedback programs. It enables the teacher trainee to receive relevant feedback on his teaching behavior while he is teaching through a feedback source located in the teaching environment.

The physical configuration of different areas of the CATTS is shown in Figure 16.1.

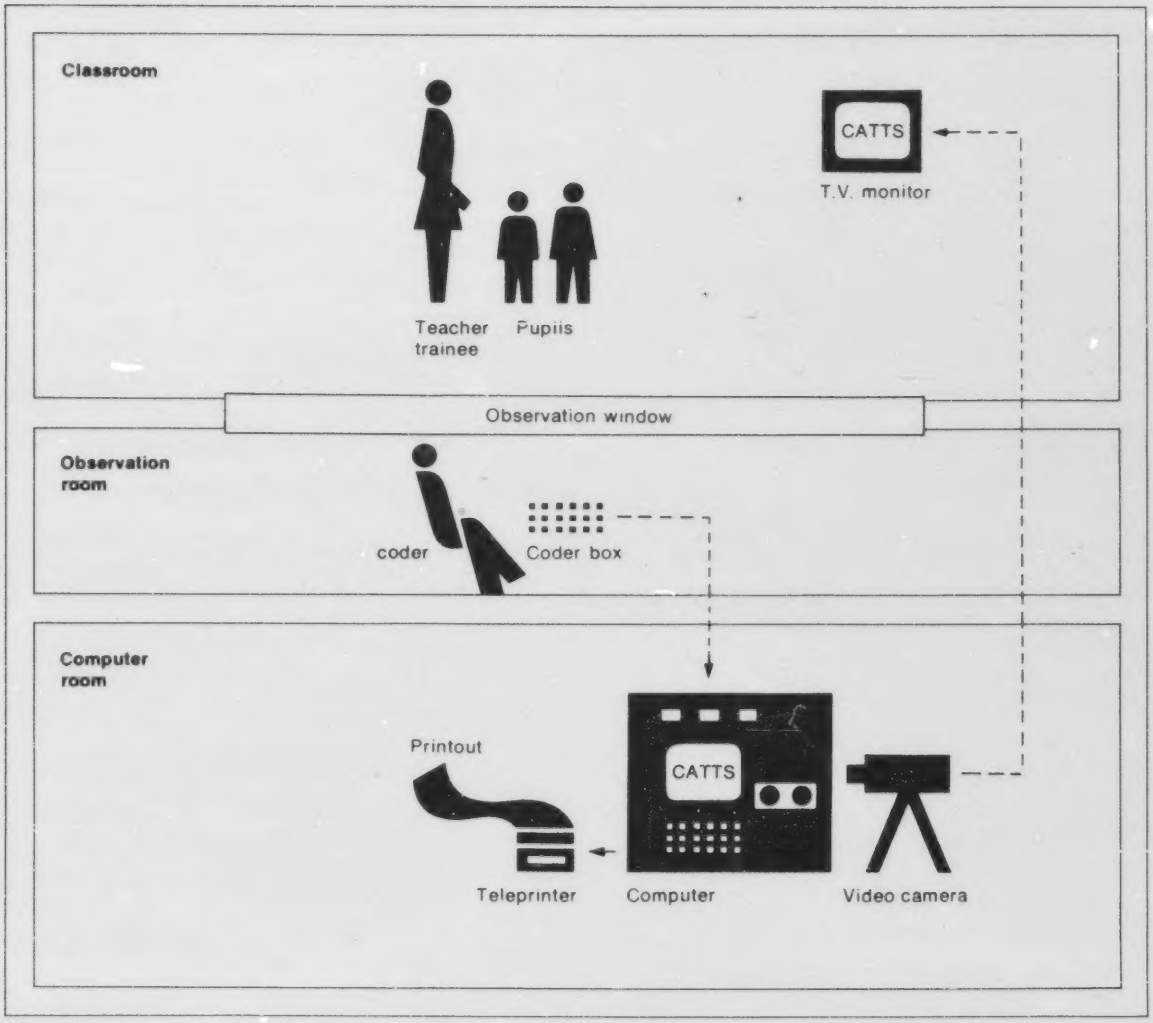


Figure 16.1.
Arrangement of Teacher Education Laboratory for CATTS.

The teacher trainee, either independently or in collaboration with his supervisor, sets up objectives for his teaching performance in terms of an observation coding system. Here are some examples:

1. There should be at least twice as much student talk as there is teacher talk during the lesson as coded on the Flanders System.
2. I should not use more than five memory questions as coded on the Individual Cognitive Demand Schedule.
3. I want to vary classroom behavior control techniques as indicated by my use of at least ten different behavior management techniques from the IBMS during my lesson.

The trainee teaches in a classroom containing a television monitor under direct computer control for the provision of feedback. In the teaching laboratory setting, the classroom is adjacent to an observation-coding station which has a one-way mirror window to permit unobtrusive observation of the class. In the on-site training situation, the observers do the coding in the classroom. The trained coder in the class or laboratory uses a device with ten mechanical pushbuttons, similar to a touch telephone, which transmits the codes to a computer in the analysis-encoding station. The computer processes the coded data, stores it, and then transmits it in the form of an easily readable frequency table or a curve to the television monitor on the teacher's desk.

As the trainee teaches a lesson, observers record the frequency and duration of relevant behavior, using the appropriate system. This information is fed directly into the computer through the pushbutton coding box. The computer processes the information, compares the present status with the trainee's goals, and feeds it back to the trainee while he is teaching. Using this feedback, the trainee modifies his performance to attain his objective. Repeated practice teaching with instant feedback should assist the trainee in developing the teaching style he desires and provide the training supervisor with objective performance data in real time.

Suggestions for further reading

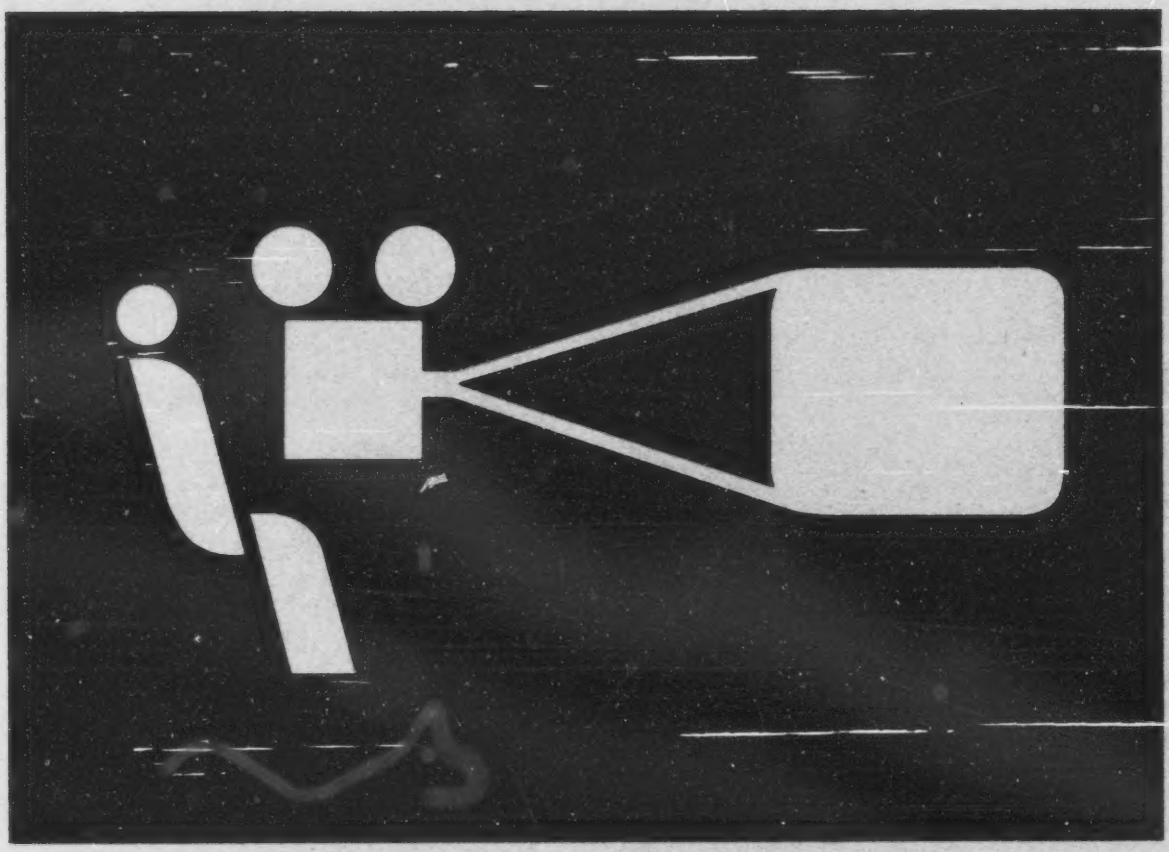
Cartwright, G. P., & Cartwright, C. A. *Computer assisted remedial education: Early identification of handicapped children.* Report No. R-36. University Park, Pa.: Computer Assisted Instructional Laboratory, College of Education, Pennsylvania State University.

Meredith, J. C. *The CAI author/instructor: An introduction and guide to the preparation of computer-assisted instruction materials.* Englewood Cliffs, N. J.: Educational Technology Publications, 1971.

Semmel, M. I., Olson, J. R., & Weiske, W. M. *An information and technical manual for the computer-assisted teacher training system (CATTS).* Bloomington, Ind.: Center for Innovation in Teaching the Handicapped, Indiana University, 1972.

Semmel, M. I. Toward the development of a computer assisted teacher training system. In N. Flanders and G. Nuthall (eds.) *The classroom behavior of teachers,* Vol. XVIII, UNESCO Institute for Education, Hamburg, Germany, 1972.

Stage III
Develop



Chapter 17
Expert appraisal

Objectives

1. Explain the relation between formative evaluation and developmental testing of instructional materials. Discriminate between expert appraisal and developmental testing in terms of the type of feedback received.
2. Discriminate between technical and instructional reviews in expert appraisal.
3. Conduct language, format, and media reviews of an instructional material. Modify the material on the basis of technical feedback.
4. Conduct expert reviews of appropriateness, effectiveness, and feasibility of an instructional material. Modify the material on the basis of expert feedback.

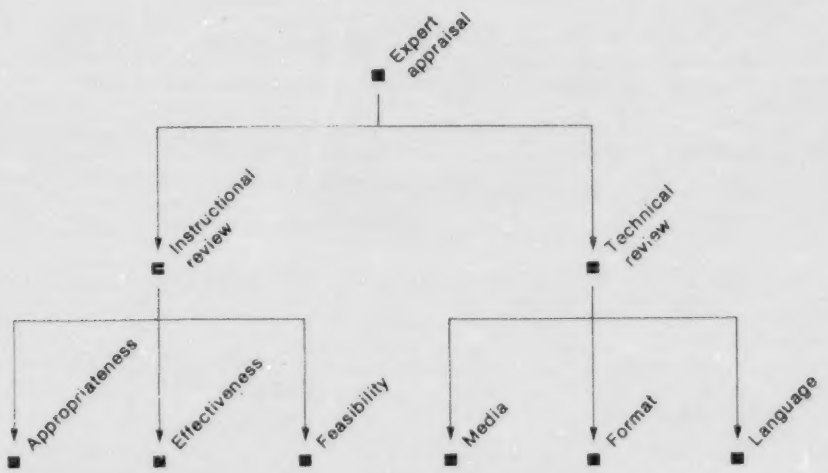
Although the discussion of the design of the instructional material is concluded at this stage, the actual development process is far from complete. The initial version of the materials developed should undergo a number of modifications before being finalized for use by trainees. Some of the modifications may be based on the developer's hindsight; most, however, will be based on feedback from others. This chapter and the following one deal with the collection of evaluative feedback for the development of instructional materials. The process is called "formative evaluation," that is, evaluation undertaken for the improvement of the instructional material.

Expert appraisal is one stage of formative evaluation. It is the process of obtaining editorial feedback from various professionals for the improvement of the instructional materials. Based upon this feedback the material is modified to improve its appropriateness, effectiveness, usability, and technical quality.

It has been suggested that the only real test of instructional materials is by students. Yet, while performance data from student tryouts are the most valuable feedback for the improvement of such materials, knowledgeable experts can provide feedback on theoretical soundness and technical quality which are beyond the student's realm of expertise. Furthermore, from a dissemination point of view, expert opinion is most important since, for better or worse, the decision to adopt the material is frequently based upon it.

Types of expert appraisal

The following figure outlines several types of expert appraisal. Expert appraisal may be conducted from either a technical or an instructional point of view. Both types of reviews are obviously important for the production of high quality instructional materials, although each relates to a distinct aspect of materials development. It is very unlikely that a special educator would want to pass judgment on the technical quality of media or language except from a user's point of view. More importantly, no media specialist would feel qualified to pass judgment upon the instructional content. On the technical side, media review deals with such factors as technical quality of production and compatibility of materials and equipment; format review deals with specialized requirements of the instructional format chosen for the material; and language review is similar to editing for technical publications. As Lumsdaine (1964) pointed out, the appropriateness, effectiveness, and feasibility of instructional materials should be reviewed. An extremely effective material is of no value if the content or objectives are inappropriate. Similarly, the most appropriate material becomes worthless if it is impracticable. Hence, the instructional review of a material involves the evaluation of all three aspects—appropriateness, effectiveness, and feasibility.



Expert appraisal of instruction materials.

Guidelines for conducting expert appraisals

Some useful inputs may be obtained by requesting a colleague to review informally the prototype instructional material. To increase the amount of feedback, however, the following techniques may be adopted:

☐ Use a wide variety of specialists from scholarly and technical areas. A professional jury should include special educators, subject-matter experts, language editors, and media production experts.

☐ Restrict each expert to his own field. It is a waste of resources to have the special educator point out errors in spelling or the language editor evaluate theoretical issues.

☐ Present only relevant parts of the instructional material for evaluation by each expert. There is no need to show the paper-and-pencil section to the film production expert. A special educator can judge the appropriateness of the content by going through the objectives and skimming through selected sections of the material.

☐ Specify the purpose of the review by each expert by defining the context in which the material is to be used and by providing him with a checklist or questionnaire.

I. Technical review

Language review

The purpose of this review is to check the appropriateness of the language for the target trainee population and the correctness and clarity of its usage. Ideally, a person with experience in editing special education publications should conduct this review. He should be provided with all verbal contents of the package, including typewritten transcripts of all audio tape recordings.

A sample checklist for the language review follows:

Checklist:
language review

Directions: Rate the material on each of the following items by circling the appropriate number in the five-point scale. In addition, edit and rewrite the material as needed.

1.	Poorly organized	1	2	3	4	5	Well organized
2.	Ineffective use of subheadings	1	2	3	4	5	Effective use of subheadings
3.	Too long or too short for the topic	1	2	3	4	5	Optimum length for the topic
4.	Confusing	1	2	3	4	5	Clear
5.	Wordy, rambling	1	2	3	4	5	Brief, concise
6.	Awkward	1	2	3	4	5	Fluent
7.	Inefficient paragraphing	1	2	3	4	5	Efficient paragraphing
8.	Technical terms left undefined	1	2	3	4	5	Technical terms defined properly
9.	Too formal or too informal	1	2	3	4	5	Suitable style
10.	Inconsistent	1	2	3	4	5	Consistent
11.	Evidence of poor proofreading	1	2	3	4	5	Evidence of excellent proofreading
12.	Too many or too few illustrations	1	2	3	4	5	Appropriate number of illustrations
13.	Illustrations are distracting	1	2	3	4	5	Illustrations are useful and relevant
14.	Not enough tables	1	2	3	4	5	Useful tables
15.	Citations and references do not accord with APA style	1	2	3	4	5	Citations and references accord with APA style
16.	Glossary needed but absent	1	2	3	4	5	Efficient glossary present
17.	Index needed but absent	1	2	3	4	5	Efficient index present

Media review

The purpose of this review is to check the technical quality of the finished product and the compatibility of the materials and equipment. The reviewer should, of course, be knowledgeable in the specific medium used for presenting the instructional content. Indicate the context in which the materials are to be used and suggest emphasis upon ways of improving the technical quality. With the rapid changes in the media field, it is not feasible to come up with a standard set of specifications or a checklist for this review; all technical details may be reasonably left to the expert.

Format review

Each instructional format has its own standards and criteria. For example, programed instruction has standards for step size, error rate, and blackout ratio (ratio of number of critical words to total number of words); simulation games have standards for model fidelity, replicability, and ratio of play time to preparation time; personalized systems of instruction have standards for course calendar, study units, and safeguards against procrastination. As in the case of media, these criteria keep changing. In programed instruction, for example, a small step size is no longer customary; in simulation gaming, the amount of structure is decreasing; and in personalized systems of instruction, the trainee is no longer given unlimited time to finish the course. Obviously, this type of technical review should be conducted by someone who is experienced in designing instructional materials in the specific format. Given only the definition of the context and the purpose of the review, the appraisal expert should be free to use his own procedures for evaluation.

II. Instructional review

Appropriateness

Appropriateness is the extent to which the objectives and the content of the instructional material are consonant with goals of teacher training in special education. People qualified to conduct an appropriateness review include special educators, scholars in specified areas, teacher trainers, and supervisors. Judgment of the appropriateness of content may be based upon such sources of information as the statement of objectives of the instructional material, the rationale for the material as given in the introduction or the trainer's manual, the table of contents, authors' outline, and opinions and review of other experts. The following checklist will aid in structuring an appropriateness review:

Checklist:
Appropriateness of instructional content

Directions: Critically inspect the instructional package and all adjunct materials. Evaluate the appropriateness of the material with respect to the goals and objectives of teacher training in special education. Rate each item on the basis of 5 points for outstanding quality, 4 points for better than average, 3 points for average, 2 points for below average, and 1 point for unacceptable. Circle the appropriate number to indicate your rating. On the second section of this checklist please give your suggestions for improving the materials.

1. Relevance of the stated objectives of the material to the general goals of teaching exceptional children.	1	2	3	4	5
2. Meaningfulness of the objectives to the *trainer*.	1	2	3	4	5
3. Meaningfulness of the objectives to the *teacher trainee*.	1	2	3	4	5
4. Sources from which the objectives are derived	1	2	3	4	5
5. Stated rationale for the objectives.	1	2	3	4	5
6. Relevance of the content to the objectives.	1	2	3	4	5
7. Theoretical soundness of the content.	1	2	3	4	5
8. Adequacy of definitions and explanations.	1	2	3	4	5
9. Use of technical terms, formulae, and notations.	1	2	3	4	5
10. Number of examples.	1	2	3	4	5
11. Authenticity of examples.	1	2	3	4	5
12. Competence of the authors.	1	2	3	4	5

Checklist:
effectiveness of instructional materials

Suggestions for modification

1. Additional objectives to be included:
2. Trivial and superfluous objectives to be deleted:
3. Suggestions for improving the face validity of the material:
4. Conceptual shortcomings and errors to be corrected:
5. Minor technical errors:
6. Examples to be added:
7. Examples to be deleted:
8. General suggestions for the improvement of the materials:

Effectiveness

Effectiveness is the extent to which instructional objectives are attained by teacher trainees who work through the material. It is evaluated by both inferring the potential effects and interpreting the data from student testing. Instructional developers provide data on the effects of various characteristics of the instructional material; evaluators may be asked to interpret performance data. It is essential to remind reviewers that the primary goal at this formative stage is to improve the material. The effectiveness checklist should be helpful in this evaluation.

Directions: Critically inspect the instructional package and the evaluation report. Suggest modifications in each of the following aspects for improving the effectiveness of the material:

1. Statement of objectives
2. Tests
3. Instructional content
4. Level of language
5. Style of presentation
6. Instructional activities
7. Difficulty level
8. Sequence of presentation
9. Practice and review
10. Feedback to trainee
11. Teacher's manual

Feasibility

Feasibility is the extent to which the material developed is usable for teacher training in special education. Personnel qualified for a feasibility review include teacher trainers, administrators of teacher training programs in special education, and directors of media and materials centers. Their estimates of the usefulness of the materals will be based upon such factors as cost of material, equipment, space, and time requirements, and acceptance by trainers and trainees. A feasibility checklist for use in this review is presented on page 135.

From appraisal to revision

The following additional resources for expert appraisal may be useful in the formative evaluation of material: A test construction expert should check the validity and reliability of the criterion-referenced tests, and a target trainee population should provide critical appraisal in addition to performance data. The developer's own hindsight on what he might have done differently should not be discounted. Not all suggestions from all sources are worthy of being acted upon. Contradictory suggestions from different experts are often encountered. For example, the subject-matter specialist may ask for "more precise terminology" while the language editor may complain of too much jargon. Expert appraisal does not reduce the number of decisions necessary; it merely presents different points of view. Decisions on which suggestions to act on must be made and then translated into actual modifications of the material. In some cases, when drastic changes are undertaken, it is a good idea to check back with the major appraisal experts involved in the original evaluation.

Checklist:
feasibility of
instructional materials

Directions: Critically inspect the instructional package and the trainer's manual. Evaluate the usability of the material in a typical special education course. Rate each item on the basis of 5 points for considerable usability, 4 points for better-than-average usability, 3 points for average usability, 2 points for below-average usability, and 1 point for virtual unusability. Circle the appropriate number to indicate your rating.

1. Adequacy of packaging.	1	2	3	4	5
2. Availability of supplementary materials.	1	2	3	4	5
3. Reusability of the materials.	1	2	3	4	5
4. Equipment requirements.	1	2	3	4	5
5. Space requirements.	1	2	3	4	5
6. Preparation time.	1	2	3	4	5
7. Training time.	1	2	3	4	5
8. Scheduling requirements.	1	2	3	4	5
9. Cost.	1	2	3	4	5
10. Trainer's manual.	1	2	3	4	5
11. Procedure for use.	1	2	3	4	5
12. Flexibility of use.	1	2	3	4	5
13. Special skills required for use.	1	2	3	4	5
14. Potential acceptance by teacher trainers.	1	2	3	4	5
15. Potential acceptance by teacher trainees.	1	2	3	4	5

Suggestions for improvement:

Chapter 18
Developmental testing

Objectives

1. Describe different stages of developmental testing and explain how the instructional material is revised at each stage.
2. Conduct developmental testing of an instructional material, first with individual trainees, then with groups, and finally under actual training conditions. Make appropriate modifications in the instructional materials and the instructor's manual.

Developmental testing involves the trying out of instructional materials on members of the target-trainee group. The purpose of the testing is to collect feedback to make the materials instructionally and motivationally more effective.

Although instructional strategies are becoming more and more refined, we are not yet at the stage of producing perfect, first draft materials. Often, a great difference is found between what experts predict and the way trainees perform. In a frequently cited study by Rothkopf (1963), experts' rankings of instructional materials correlated *negatively* with student outcomes. Thus, data from student testing remain the most valid predictors of potential problems.

Three phases of developmental testing

Experienced instructional developers undertake developmental testing in three stages. In the first, the materials are tested in a face-to-face situation and revisions are made on the spot. After eliminating obvious problems, quantitative testing of the materials in their "final" format is undertaken and further modifications are made. Finally, in the total-package testing, other teacher trainers are asked to use the materials under actual training conditions and to suggest changes to improve the usability of the package. The following table summarizes these three stages of developmental testing.

Three stages of developmental testing.

Stage	Tryout situation	Type of students	Type of data	Revision	Number of sessions
1. Initial testing	Individual teacher trainees or small groups in a face-to-face situation with the instructional developer	Selected teacher trainees	Qualitative. Responses, reactions, and comments from teacher trainees	Some on the spot, others after each tryout session	Four or five (until consistent results are obtained)
2. Quantitative testing	In actual training situation under the direction of the instructional developer	Teacher trainees enrolled in a course or workshop	Written responses. Also responses to questionnaires	Systematic revisions based on data analysis	One or two depending upon extent of revisions
3. Total-package testing	In actual training situations *without* the instructional developer	All teacher trainees enrolled in a course or workshop	Responses to tests and questionnairs. Instructor comments and suggestions	Revisions of instructor's manual and adjunct materials	One or two

Initial developmental testing

Instructional materials should be tried out with teacher trainees as early in the developmental process as possible, even in their unfinished state. Obviously, it is cheaper to modify a rough sketch than a finished slide. The earlier testing and modification begin, the easier problems can be eliminated. Also, during initial stages the developer is more apt to be objective.

To maximize feedback, a "lean" version of the material containing a minimum amount of instructional content is used at the initial testing stage. It permits the location of areas in need of additional instruction—an easier task than identifying redundant or superfluous content.

Initial developmental testing is conducted in a clinical setting with the teacher trainee and the instructional developer working together. Tryouts are conducted individually, unless, of course, the instructional format requires small groups. If, for some reason, it is not feasible for the developer to conduct the tryouts, the person substituting for him should be fully briefed on what not to do as well as what to do.

The teacher trainees selected for initial testing should be enthusiastic and communicative. Being an

authentic representative of the target-trainee population is less important at this stage than the ability to verbalize problems. During the actual testing session, the teacher trainee is given a copy of the material and asked to work through it. He should be reassured that it is the material which is being tested, not his ability. Avoid communicating your personal involvement in the materials; do not call them "my" products. Say that they were put together by a group of people (which is usually true) and that you are helping to locate problem areas and weak spots. The trainee should also be told that your role is not to teach him but to watch him try to learn from the material. Resist the temptation to rush to his aid every time he hesitates or makes an error. Instead, ask if he would mind thinking aloud to help you understand what is bothering or confusing him. Requests for assistance indicate that the material should be modified. The trainee should then work through the revised version.

Programed instructional materials permit tracking the trainee's learning through the responses made in each frame. If the format of the material does not require the trainee to make such periodic responses, identify all logical units of instruction and prepare a probing question at the end of each. At least, require the trainee to summarize everything learned in the unit. Also monitor spontaneous comments (e.g., "That's a drag!") and nonverbal reactions (e.g., counting the number of pages still to be read) that indicate motivational weaknesses in the material. Tryout sessions should be concluded before the teacher trainee becomes tired. After each testing session, interview the trainee for additional information and suggestions. If the trainee did not respond frequently during instruction, an informal oral posttest may be given.

On-the-spot changes should be incorporated in the material and additional modifications should be undertaken immediately after each developmental testing session. It is not the number of tryouts but the quality of revisions that improves the material. The trainee should, of course, be tested with the revised version. When the material begins producing consistent results in the test-revise-retest cycle, a second (quantitative) stage of developmental testing is called for.

Quantitative developmental testing

The purpose of this stage is to further refine the material on the basis of quantitative feedback. Before undertaking the actual tryout, produce duplicate copies of the revised version of the material and copies of criterion-referenced tests (see Chapter 7). In addition, prepare instruments to measure the trainee's attitude toward the content and the format of instruction. A number of informal techniques for questionnaire construction are described by Mager (1962). Among the more formal techniques, Likert (1932) scales and semantic differentials (Osgood, Suci, & Tannenbaum, 1957) are useful. Figure 18.1 shows a sample semantic differential to measure the trainee's attitude toward the content, and Figure 18.2 shows a Likert scale that measures the trainee's attitude toward the format (viz., instructional games).

Given below are some pairs of adjectives which may be applied to informal reading tests. Between each pair there are five blanks. Place an "X" in the blank which is closest to the way you feel about informal reading tests.

unpleasant	___	___	___	___	___	pleasant
useful	___	___	___	___	___	useless
dull	___	___	___	___	___	stimulating
powerful	___	___	___	___	___	weak
effective	___	___	___	___	___	ineffective
clear	___	___	___	___	___	unclear
relevant	___	___	___	___	___	irrelevant
practical	___	___	___	___	___	idealistic
personally helpful	___	___	___	___	___	not personally helpful
appropriate	___	___	___	___	___	inappropriate
beneficial	___	___	___	___	___	not beneficial
novel	___	___	___	___	___	traditional
important	___	___	___	___	___	unimportant
interesting	___	___	___	___	___	boring
efficient	___	___	___	___	___	inefficient
costly	___	___	___	___	___	inexpensive
valuable	___	___	___	___	___	valueless

Figure 18.1.
Semantic differential on informal reading tests.

Read the following statements about instructional games. Indicate the extent of your agreement or disagreement with the statement using the following key:

A—strongly agree
B—agree
C—undecided
D—disagree
E—strongly disagree

___ 1. Playing the game has been a total waste of time.

___ 2. Games are for kindergarten.

___ 3. Games are fun.

___ 4. Lectures should be replaced by games like this.

___ 5. It is impossible to learn anything worthwhile from games.

___ 6. I'd rather read a textbook than play silly games.

___ 7. Games are not for me.

___ 8. Games are more realistic than other classroom activities.

___ 9. You learn a lot of useful things when you play a game.

___10. I'm glad my other classes don't use games.

___11. Games make learning interesting.

___12. If I were a teacher, I'd use a lot of instructional games.

___13. I prefer any other method of learning to playing games.

___14. I would not mind if I never play another one of those games again.

___15. Games sure beat listening to lectures.

___16. I could have played the games forever.

___17. Games take the seriousness out of education.

___18. Games help us learn from each other.

___19. Anything that is learned through games is easily forgotten.

___20. Games never teach.

Figure 18.2.
A Likert scale on attitude toward instructional games.

Finally, an instructor's manual specifying details of use should also be developed for the material at this stage.

Begin the second-stage tryout by administering entry and pretests to trainees. Next, distribute copies of the instructional material with instructions to trainees to work independently. Follow the directions in the instructor's guide but if the procedure must be changed for any reason, incorporate the change in the manual. Administer the posttest as soon as each trainee completes the material.

After the tryout, tabulate the data from the posttest and locate those sections of the instructional material that need strengthening. Table 18.1 may be used to analyze the pattern of errors.

If the same error is made by a majority of trainees (e.g., Item 8 in the table), try the following modifications:

☐ Check the test item for ambiguity. Rewrite it if necessary.

☐ Check individual responses for consistent misconceptions. Revise the appropriate section of the material.

☐ Check the entry-test performance of teacher trainees who made the error. If you have made any false assumptions about their entry levels, begin instruction at a more elementary level.

If an item is missed by a number of learners but not the majority (e.g., Item 4 in the table), try these modifications:

☐ Check individual responses for consistent misconceptions. If there are any, prepare a remedial section for use by the trainees missing the item.

☐ Check the entry-test performance of the trainees who made the errors. If they lack any essential prerequisite, prepare supplementary material for their use.

Name of trainee	Posttest item									
	1	2	3	4	5	6	7	8	9	10
1.				–				–		
2.				–						
3.										
4.								–		
5.							–	–		
6.				–				–		
7.	–							–		
8.								–		
9.				–				–		
10.								–		
11.				–				–		
12.	–									

Table 18.1
Analysis of responses to posttest questions. Minus sign (–) indicates an error.

If an item is missed by very few trainees (e.g., Item 7 in the table), no special revision is necessary. Even with the most effective materials, random errors can be expected.

You may find suggestions for other revisions in the trainees' comments. Data from attitude questionnaires can also be tabulated to locate consistent complaints. If one trainee claims that the protocol film looks artificial, the comment may be disregarded; but if all trainees report the same feeling, drastic revision is suggested.

Total-package testing

After making modifications on the basis of quantitative tryouts, test for comprehensiveness and precision of the material. The instructor's manual is also reviewed at this stage.

Total-package testing requires the cooperation of other trainers who teach a course in which your material could be used. Ideally, a trainer from an institution other than your own should be chosen. Send him a sufficient number of copies of the material along with the instructor's manual. Encourage independent decision-making when minor problems arise in the field. At the end of this field testing (or periodically during it), ask the trainer to collect and send the comments and responses made by trainees. In addition, ask him for his opinions and suggestions, either informally or by responding to a questionnaire, such as the following one:

Sample trainer questionnaire for total-package testing. This questionnaire was used during the field testing of the instructional game ANTICIPATION (Semmel, 1971).

Anticipation game data

1. Title of the course or workshop:
2. Information about teacher trainees:
   a. number of trainees:
   b. level of trainees:
   c. special characteristics:
   d. names of trainees who did not participate in all sessions:
3. Time data:
   a. class meetings
      1. frequency:
      2. duration:
      3. number of sessions:
      4. total time:
   b. preparation
      1. instructor's time spent in planning the game sessions:
4. **Instructor's role:** (Briefly describe the role you played in introducing, conducting and debriefing the games.)
5. **Game equipment**
   a. Did you have all necessary equipment? ( ) yes ( ) no

      If *no*, what items did you lack?
      How did you handle their absence?
   b. What problems did you have with the use of the equipment?
   c. In what ways could the equipment be improved?
6. **Rule book:**
   a. Did you find the rules clear? ( ) yes ( ) no
   b. Did any issues arise during the play of the game which were not covered in the rule book? ( ) yes ( ) no

      If *yes*, please specify the problem.
      How did you handle it?
   c. Suggestions for improvement of the rulebook:

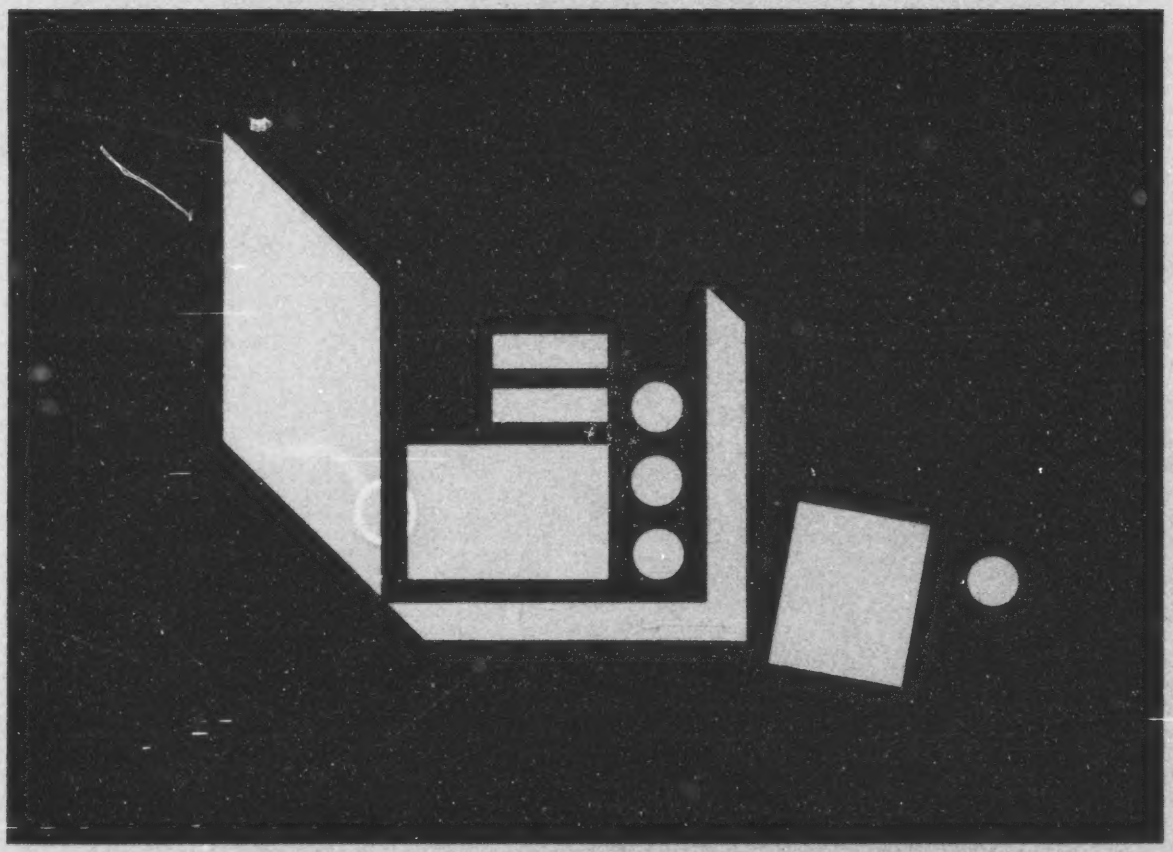
7. **Activities:**

   a. What games and activities did you omit from those suggested in the Instructor's manual?

   b. What games and activities do you believe could be omitted without detracting from the attainment of the objectives?

   c. List and describe any additional games or activities you used:

Stage IV
Disseminate



Chapter 19
Summative evaluation

Objectives

1. Differentiate between formative and summative evaluation and describe different types of summative evaluation.
2. Describe the procedure for summative evaluation of an instructional material.
3. Select an appropriate design for the evaluation of a given instructional material.
4. Construct or collect various tests and measuring instruments for the summative evaluation of an instructional material.
5. Analyze data from summative evaluation and report it in a suitable format.

Production of the final version of an instructional material is indicated when the formative evaluation yields consistent and positive results. However, prior to the packaging and dissemination of the materials a summative evaluation is required.

The purpose of the summative evaluation differs from that of the formative evaluation in that its goal is to describe the effects of the instructional material rather than to improve its effectiveness. In summative evaluation, a representative group of target trainees works through the material under specified conditions. Data are collected on the characteristics of the trainees; the changes in their skills, knowledge, and attitudes; the context in which the material is used; and the time requirements. In addition, summative evaluation also involves professional jurying, that is, a panel of experts critically appraising the material and providing opinions on its content, strategies, and production quality.

Three phases of validation testing

Internal validation. This phase identifies the extent to which the instructional material effectively teaches what it is supposed to teach. It tests the trainee by criterion-referenced test immediately after instruction to check the attainment of the instructional objectives. For example, if the objectives of an instructional material are for the trainee to administer an informal reading test to EMR children and to interpret the results accurately, the trainee may be tested on his ability to list the various steps involved, formulas to be used, and precautions to be observed. The trainee's ability to identify and classify different types of disruptive behaviors, choose the most appropriate control technique, and

describe the procedure for applying the technique may be used to test instructional materials on classroom control.

Internal validation is usually undertaken during or immediately after teacher trainees complete the instructional material. The most important measuring instrument in this phase is the criterion test which is based on the objectives of the instructional material. The test is usually constructed by the developer.

Transfer validation. Even when internal validation indicates that the trainee has mastered a certain skill or knowledge, there is no guarantee that it will be applied in everyday teaching behavior. Transfer validation measures the extent to which a teacher's real-world performance is affected by the skill or knowledge he has acquired from the instructional material. This phase of validation usually occurs during the trainee's practice-teaching sessions or in actual classroom teaching. Self-reports from trainees as part of their regular record-keeping responsibilities, and observation coding systems used by supervising teachers or peers, enable the collection of valid data unobtrusively. For example, the teacher's records may be inspected to check the extent of the actual administration of informal reading tests in the classroom and the use of the results to prescribe suitable reading materials. The supervising teacher can use a checklist to count the number of times and note the skill with which a teacher uses certain control techniques to stop disruptive behavior in the classroom.

Payoff validation. The ultimate criterion for effective teacher training is facilitation of exceptional children's learning. Changes in teacher performance are not ends in themselves but the means of increasing learner achievement. Obviously, the developer of any instructional material is confident that the skill or knowledge he has presented will improve children's performances. Such confidence is warranted when the materials are based on sound theory and/or research. Payoff validation provides an opportunity to substantiate this assumption. As Okey and Ciesla (1972) pointed out, the emphasis in this phase is not on the acquisition of a skill, but on the effects of using it. The most important aspect is testing children and measuring the extent to which their achievement results from the trainee's newly acquired skills. For example, the payoff validation of the skill of administering informal reading tests is the assessment of whether a reduction has occurred in the number of reading errors children make. Similarly, ascertaining whether a measurable decrease of disruptive behavior in the classroom has occurred validates the effect of the trainee's acquisition of new control skills and techniques.

Guidelines for validation testing

Figure 19.1 outlines the different steps in the validation testing of an instructional material. Initially, a number of sets of the material must be produced with a specific strategy for using the material. Before actual evaluation can take place, a suitable design is selected, appropriate tests are constructed and collected, and arrangements are made for subjects to work through the materials. The actual evaluation involves the testing of trainees to identify their entry level, requiring them to work through the material under specified conditions, and testing them again to measure changes in their skill, knowledge, or attitudes. Finally, data from the valiation study are analyzed, interpreted, and reported.

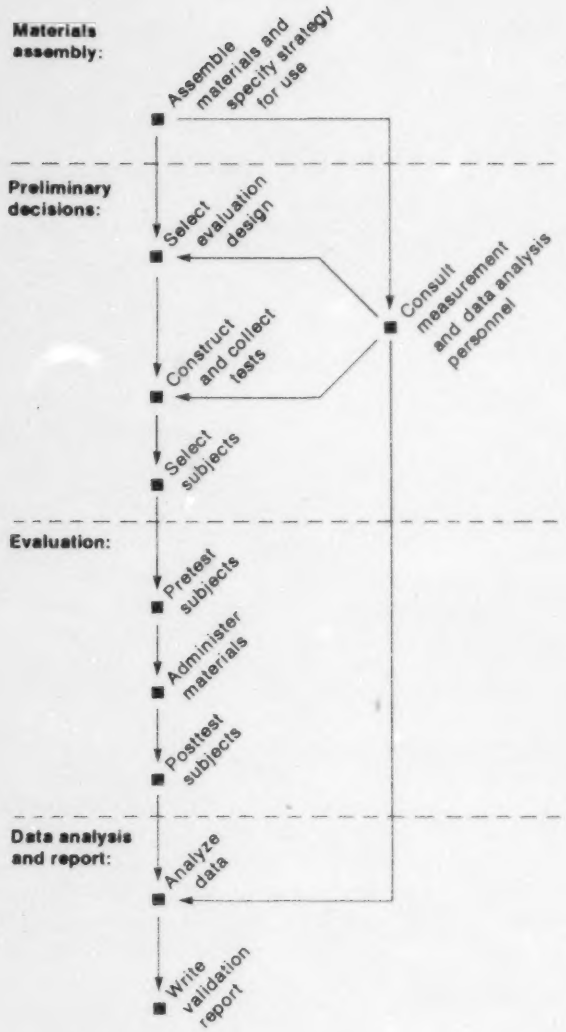


Figure 19.1.
Steps in validation testing of instructional materials.

Assembling instructional material and specifying mode of use

Occasionally, the developer may forget the primary goal of summative evaluation and revise the material while he is conducting the test. In this situation, the evaluation loses replicability and reverts to the formative stage. Revisions in the material and the strategy for use do not guarantee improved effectiveness until another round of testing with the revised package warrants such a conclusion. For maximum replicability of results, it is essential to assemble enough sets of the material in its final format and to stipulate specific guidelines on how to use them. The procedure recommended in the instructor's manual should be rigidly followed in validation testing.

It is important that some form of process evaluation take place during the summative test in order to determine, just as in formative evaluation, whether the treatment was implemented as intended. The difference in process evaluation at the formative and summative stages is that in the former it is used for either revising the treatment or the strategy by which it is implemented and in the latter it is used to validate the summative test. Unless you can document that the material was reasonably well implemented at the time of the summative test, the results will always be open to rival hypotheses, especially with a "no significant difference" or unexpected "control is better than experimental" outcome.

Many educational treatments fail their summative evaluations because they were not implemented as the developer had intended. The importance of validating the processes during the delivery of the treatment cannot be overstated. Unless one can document that the materials tested were implemented as intended during the summative evaluation, the

results will frequently be uninterpretable.

There are many ways by which materials can be varied in their presentation, thus altering significantly the intended process and, possibly, the desired outcome. Three of the more common sources of departure from standardized delivery of an instructional material are,

Timing: The material was designed for use within a 45-minute period but actually took 120 minutes to complete.

Sequencing: Components of the material were designed for presentation in a specific sequential order (A, B, C) but were, in fact, presented in a different order (e.g., B, C, A).

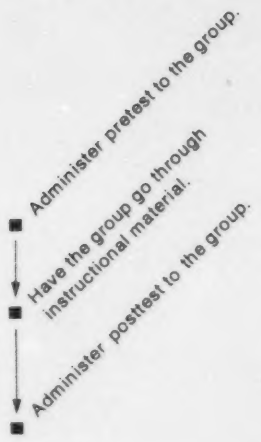
Completion: The material was designed to be used in its entirety but some trainees skipped sections.

Process measures are invaluable to the understanding of a summative evaluation. We would do well to remember that an educational treatment consists of both the instructional material developed and the actual operations of the delivery system during the summative evaluation. It is not enough to describe the intended process—we must directly observe the implementation of instructional materials.

Selection of evaluation design

Instructional format, length of time, extent of trainer participation, and availability of subjects for testing—all impose restrictions on the choice of evaluation design. Six designs for internal validation of instructional materials and two for payoff validation are outlined below. All designs are based on Campbell and Stanley's "Experimental and quasi-experimental designs for research on teaching" (1963).

One group pretest-posttest design



This schema outlines a simple before-and-after design. A group of teacher trainees are pretested on the instructional objectives before they work through the instructional material; immediately afterwards they are given a posttest. Improvement in test performances may reflect the effectiveness of the instructional material.

This particular design suffers from so many invalidating factors that Campbell and Stanley (1963) classified it as pre-experimental and used it as a "bad example" to illustrate confounding variables. However, in many training situations, where it is impossible or undesirable to deny instruction to a sub-group of trainees, this design may be the only usable one. It is especially useful for the summative evaluation of short modules. The brief duration of instruction prevents confounding through history

(i.e., outside occurrences influencing learning) and maturation (i.e., trainees growing up into better performers). Another confounding variable in this design is that taking the pretest affects the trainee's level of motivation and sensitizes him to pay special attention to certain facts and concepts. However, since many modules incorporate the pretest as an instructional component, what is measured is the effect of the pretest and the material as a total package.

Figure 19.2 is based on data from a validation study using the one group pretest-posttest design. As a pretest, teacher trainees were administered a criterion-referenced test on grouping EMR children for instruction. After completing an audiotutorial module on the topic, they were given an equivalent form of the criterion test as a posttest. Notice the normal distribution of fairly low scores on the pretest and the positively-skewed distribution of high scores on the posttest, indicating the effectiveness of the module for the trainees in the study.

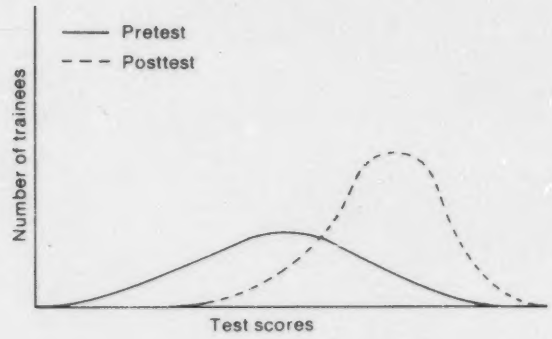


Figure 19.2.
Data from a one-group pretest-posttest study.

Control-group design 1.
Isolating effects of instructiona. material

With more complex instructional materials which require longer periods of time, it is not at all feasible to isolate and control the experiences of trainees. In such cases, a control group is required in order to establish the effects of such confounding variables as history, maturation, and testing. In the pretest-posttest control group design, trainees enrolled in a course are randomly assigned to two groups. Both groups are administered the pretest and, after a suitable lapse of time, the posttest. In between, only the experimental group works through the instructional material. Any confounding factor that aug-

ments the posttest performance of the trainees should operate equally on the control group. After taking this factor into account, whatever differences are obtained in the performance of the experimental group may be inferred to be the effects of the instructional material rather than of history, maturation, or testing. The data say nothing, however, of the superiority of the material compared to other instructional programs.

Figure 19.3 is based on data from a control-group validation test of a 20-hour instructional package on behavior management techniques. Although the control group shows some gain in performance, the gain of the experimental group is noticeably larger.

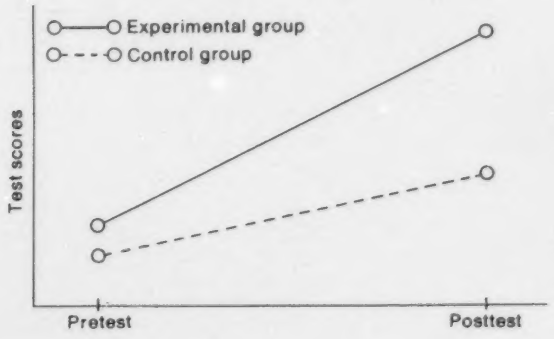


Figure 19.3.
Data from a pretest-posttest control group study.

Control-group design 2.
Comparison of two different instructional modes

The nature of teacher-training courses is such that it is very difficult to withhold instruction from a sub-group of trainees to form a control group, as required in the previous designs. To circumvent this difficulty, the experimental group is put through the instructional material while the control group receives instruction through a "conventional" format.

Control-group design 3.
Using intact classes

This design offers an alternative solution to the problem of withholding instruction from a control group. In large teacher-training programs, more than one section of trainees often are available. Two intact classes of trainees can be used as experimental and control groups. Instruction is not denied to the control class; it is merely postponed to a later semester. The only difference between this nonequivalent control group design and design two is that the trainees are not randomly assigned to groups. Any natural biases in the enrollment in the different classes will confound the effect of the instructional material. An evening class, for example, is more apt to contain inservice teachers than a class that meets during the day.

Control-group design 4.
Within class posttest only

Another problem with the evaluation designs presented thus far concerns the administration of the pretests, particularly lengthy tests, and their effect on the control group. Campbell and Stanley (1963) pointed out that if trainees are randomly assigned to groups, there is no need to administer a pretest. In the posttest-only control group design diagrammed above, two random groups are created, one learning from the instructional material and the other receiving no instruction. Both groups are posttested after the experimental group completes the material.

Figure 19.4 is based on data from a validation test using the posttest only design. Notice the similarity between this figure and Figure 19.2 which shows results of a one-group, pretest-posttest study.

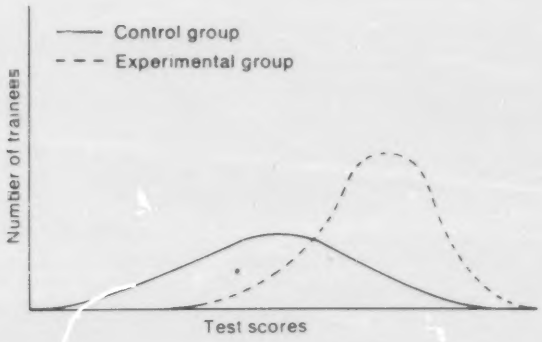
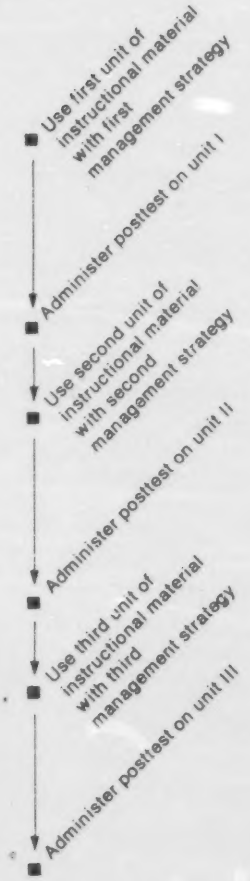


Figure 19.4.
Data from a posttest-only control group study.

Validating managerial formats
Equivalent-materials samples design


Use first unit of instructional material with first management strategy
Administer posttest on unit I
Use second unit of instructional material with second management strategy
Administer posttest on unit II
Use third unit of instructional material with third management strategy
Administer posttest on unit III

This design is especially useful for establishing the effects of management formats. No control groups are needed since each learner serves as his own control. At the beginning of the study, a number of equivalent units of instructional materials are assembled. The units are used alternatively with two different strategies. For example, the odd units may be accompanied by behavioral objectives, and the even ones may be used without them. Or, every other unit may permit repeated testing while the others allow only a single test.

Figure 19.5 is based upon data from eight equivalent directives. Four contained sets of specific behavioral objectives, the other four did not. Note the obviously more effective results from the repeated-testing format. It should also be noted, however, that the equivalent-materials design diminishes in usefulness as the number of equivalent materials are increased. Because the design functions without a control group and the same sample receives repeated applications of equivalent materials, learning to learn, learning set, and accumulative learning may work to diminish between-material-variance toward the end of a lengthy cycle. Thus, the eight equivalent treatments measured in Figure 19.5 may not have been a wise application of the design.

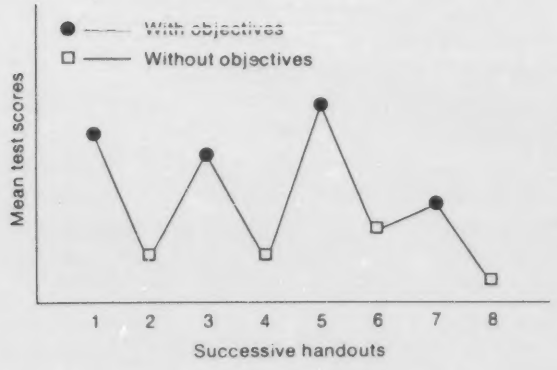
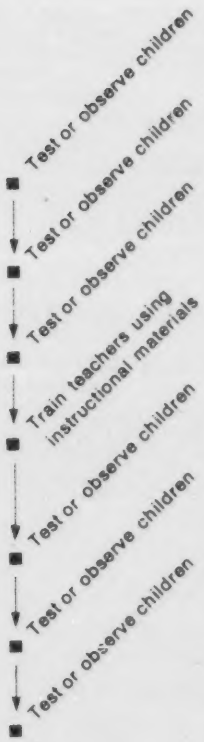


Figure 19.5.
Data from an equivalent-materials sample study.

Payoff validation 1.
Time series


Test or observe children
Test or observe children
Test or observe children
Train teachers using instructional materials
Test or observe children
Test or observe children
Test or observe children

Payoff validation involves the measurement of the ultimate impact of the instructional material on exceptional children rather than the immediate changes in the teacher's behavior. In the illustrated time series design a class of exceptional children instructed by a particular teacher or trainee is administered a series of periodic tests (e.g., weekly arithmetic tests). These tests begin long before the teacher trainee encounters the instructional material and continues after the material is completed. The effect of the newly acquired skill and knowledge is assumed to be reflected in the children's performances in the later series of tests.

Figure 19.6 is based on the data from seven EMR children taught by the same teacher. The teacher worked through an instructional package on prescriptive teaching of arithmetic after the first three tests. Notice the general reduction in the number of errors made by the children in subsequent tests, which is some evidence that the instructional package had an impact on children's performances.

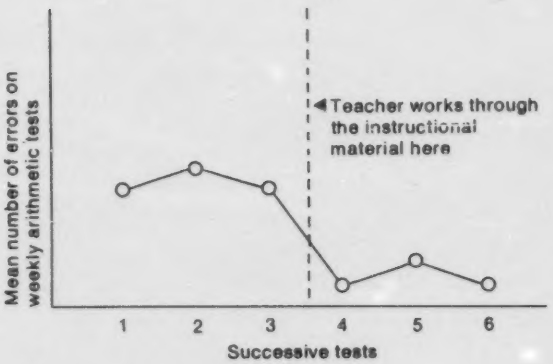
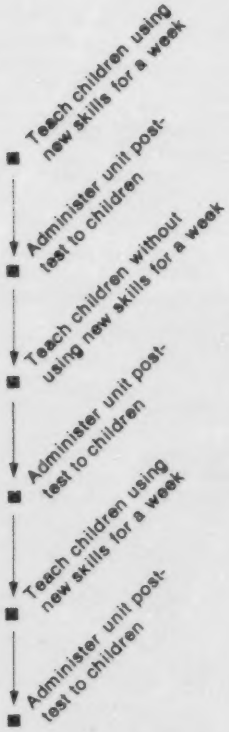


Figure 19.6.
Data from a time-series study.

Payoff validation 2.
Equivalent time samples design


Teach children using new skills for a week
Administer unit post-test to children
Teach children without using new skills for a week
Administer unit post-test to children
Teach children using new skills for a week
Administer unit post-test to children

This "on-and-off" design is similar to the equivalent-materials samples design discussed earlier. The design is useful for checking the payoff validation of an instructional package after the teacher trainee has acquired some new teaching technique. The trainee is instructed to teach for equivalent periods of time (e.g., a week) alternatively using and not using the new teaching technique. The trainee also administers a posttest at the end of each time period on the topics covered during that period.

Figure 19.7, based on data from Okey and Ciesla (1972), indicates how the use of skills from a module called *Teaching for Mastery* makes a difference in the performance of 29 students in a sixth-grade classroom.

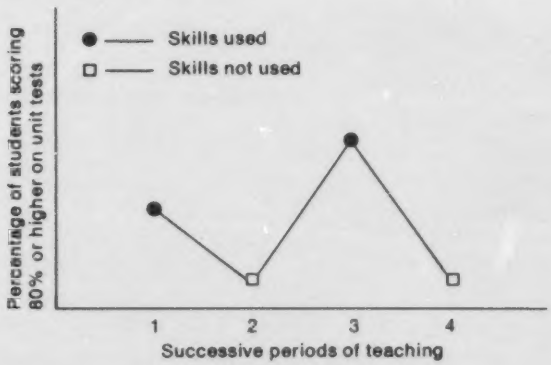


Figure 19.7.
Data from an equivalent time samples study.

Single subject designs

A number of useful single subject designs also have been developed primarily for the study of behavior modification. They have not, as yet, been widely applied to the evaluation of instructional materials. However, there appears to be great potential in the utilization of single subject design in the evaluation of instructional programs. A useful review of the major single subject designs can be found in Wolf and Risley's chapter, "Reinforcement: Applied research" (1971).

Additional sources of evaluation information are listed in the selected bibliography at the end of this chapter and, also, in the bibliography on tests and test construction at the end of Chapter 7.

Constructing and collecting tests

The types of tests used for validation may be classified as input, process, and output measures.

Input measures check the entry behaviors and characteristics of teacher trainees *before* they receive instruction. These measures help to answer such questions as, "How many of the skills did the trainees already possess?" "In what ways do these trainees differ from the target population for the material?" and "How do trainee preferences interact with the rate at which they learn from the material?"

Process measures keep track of the events *during* the period that the teacher trainee works through the instructional material. They help to answer such questions as, "How long is the trainee able to work at the material without fatigue?" and "What major problems are faced by the trainee in using the material?"

Output measures test the trainee's achievement *after* instruction. They help to answer questions about changes in his behavior, knowledge, and attitude.

Here is a brief description of specific tests from each category

Input measures

Aptitude tests. These tests, usually standardized, measure teacher trainees' aptitudes that relate to the skill to be learned. An aptitude test on listening comprehension, for example, may be administered to the trainee before he goes through a training module on appropriate reactions to children's questions, if the developer believes that the skill is related to the aptitude. The use of aptitude tests permits identification of the characteristics of those trainees who benefit most from the instructional material.

Entry questionnaire. Information on various educational and experiential aspects is collected from the trainees through a questionnaire. Previous teaching experience, including number of years and type of children taught, is an example of relevant data collection.

Entry test. This criterion-referenced test measures the *prerequisite* skills and knowledge necessary for the effective use of the instructional material. In Chapter 7, the details were discussed of constructing such a test from the statement of entry behaviors. An ideal entry test helps the trainer to diagnose exact deficiencies and prescribe suitable remedial instruction.

Pretest. Also a criterion-referenced test constructed by the developer, the pretest is designed to measure the extent to which the teacher trainee has already attained the objectives of the instructional material.

Process Measures

Self-reports and observation systems. Frame-by-frame responses of a student progressing through a programed instructional unit is an example of process data. The trainee's learning behavior may also be observed with a suitable coding system. In an instructional game, for example, the degree of each trainee's involvement can be observed and recorded. In addition, trainees can be asked periodically to check relevant items on a self-report checklist which describes their feelings and reactions to the material.

Output Measures

Posttest. A parallel form of the pretest, the posttest is taken by the trainee upon completing the instructional material. It is constructed by the developer and it is based on the objectives of the instructional material. Comparison of pretest and the posttest performances assists in measuring the gains in the trainee's achievement.

Transfer test and observation systems. This performance test most often requires the trainee to teach in a real classroom. A suitable checklist or observation system may be used unobtrusively to measure the extent to which the trainee applies his skills and knowledge to the classroom situation.

Attitudinal measures. In addition to teaching the trainee new skills and knowledge, the instructional material may be instrumental in changing his attitude. The construction of scales and questionnaires by which the developer can measure these changes was discussed in the chapter on formative evaluation. The same type of instruments may also be used for summative purposes.

Conducting the validation test

The choice of a teacher trainee population for summative evaluation depends upon both needs and availability. The particular evaluation design also dictates how the subjects should be selected and assigned to various groups. Federally funded projects are required to adhere to government regulations on the use of human subjects. The publication, *The institutional guide to DHEW policy on protection of human subjects* (1971), outlines these regulations.

In the selection of subjects, relevant information on them, such as IQ, achievement, and grade point average, can often be obtained from the records of public institutions. If pretesting is essential to the design, sufficient time should be allowed to schedule the test after the subject selection and before the teacher trainees go through the instructional material. During instruction, the necessary steps should be taken to insure adherence to the use strategy stipulated in the teacher's manual. After instruction, posttesting can be immediate or it can be delayed for a period of time, depending upon the validation phase. In either event, posttesting is usually more complex than pretesting.

Analyzing data

It is strongly recommended that the instructional developer consult with a measurement and data analysis expert as early as possible in the planning phases of a validation study. Early consultation can frequently avoid costly delays and *post hoc* data analysis. Data analysts are usually more helpful and cooperative when given an opportunity to assist in the plan for treating the data prior to the collection of the data.

After validation testing, the various instruments are scored, coded, transferred to computer cards, and analyzed according to a pre-designed procedure. If quality control measures have been carefully attended to throughout the formative evaluation stages, the data will be unlikely to indicate that the instructional material is totally unreliable or ineffective. However, some unanticipated weaknesses, which indicate that the material is not yet ready for large-scale dissemination may be discovered. In this case, results from the valiation testing should be analyzed to provide additional formative feedback, and suitable modification should be made. Unless these revisions are minor, summative evaluation should be

repeated with the modified material to ensure that the effectiveness has been improved. When validation testing yields positive results, an evaluation report can be written and the final packaging and distribution of the material can begin.

Professional jurying

Techniques for collecting expert opinions on the appropriateness and technical quality of instructional materials were discussed in Chapter 17. The same procedure may be used again for professional jurying of the total package. Expert opinion in this case is not used to modify the material but to provide the consumer with objective appraisals. Both positive and negative opinions should be reported as a part of the final validation report.

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Chapter 20
Final packaging

Objectives

1. Prepare the instructional material for final packaging by obtaining necessary permission and releases.
2. Consider authorship rights and how to obtain a copyright.
3. Provide rationale for high production standards in final packaging.

Throughout the earlier stages, the need for considering various dissemination issues has been stressed. With the completion of summative evaluation, the dissemination issue comes to the fore. Modesty and reluctance may prevent the developer from pushing his materials, but, if they have been systematically developed and empirically validated, it is the developer's responsibility to give them the widest possible dissemination. In many instances, teacher trainers develop materials and programs to meet local needs and conditions and make no effort to disseminate them. They cannot or will not consider the issues involved in getting the materials to other programs in which they could be used. Through the widespread communication of training program developments, field-wide progress toward a more sophisticated corps of well-prepared special education teachers may be realized and the wasteful duplication of effort prevented. The major professional organizations in the field of special education, in recent years have begun to recognize their reciprocal responsibility toward the individual and group program innovator by sponsoring and encouraging dissemination activitites. Some of these developments are discussed in Chapter 21.

The skills required of a disseminator are quite different from those of a developer; consequently, packaging and distributing responsibilities may have to be turned over to another person or team. This chapter discusses some practical packaging considerations that apply to small-scale-developer produced packages as well as to commercially produced materials.

Selecting the producer and the disseminator

The producer who undertakes the production of multiple copies of the final version of an instruc-

tional material may be a printer, film-maker, or packager. The disseminator markets or distributes the material. The same person may serve both functions, as in the case of publishing. Very few teacher-training programs in special education are equipped to undertake either activity. Many commercial organizations may be eager to undertake the final production for a fee but very few, if any, are enthusiastic about marketing the materials because the market for special education teacher-training materials is very thin. It has been variously estimated that the maximum sale is around 2,000 copies directly to trainees or 200 to teacher-training programs, over a period of five years. The reluctance of commercial sources to disseminate special education materials suggests the need for a combination of commercial production and local distribution.

Obtaining releases

Before final production, the developer must obtain certain clearances. For example, permission is needed to quote from other copyrighted materials. No special permission is required for quoting from materials in the public domain (e.g., legal documents and books published more than 56 years ago). Usually, permission is not needed to quote passages of less than 150 words from textbooks. However, it is a courteous gesture to request permission to quote even short passages. With trade books, ask permission before quoting anything. Even if not quoting directly but merely paraphrasing or adapting another author's ideas, permission should be obtained. All permissions must be secured from the holder of the copyright, who may or may not be the author. A model letter for asking permission is given in Figure 20.1.

Dear Sir (Gentlemen):

I (we) would like to have your permission to use the following copyrighted material in my (our) book (instructional module, film) entitled (title of the instructional material) to be published (distributed) by (name of the publisher or disseminator) around (approximate date of publication).

Direct quotation of approximately ..... words beginning with the words "....." on page ....., line ....., and ending with the words "....." on page ....., line .....

Condensation(s) (paraphrase(s)) of material appearing on page .....

Illustrations (Figure .....) from page .....

We will be using the following credit line to acknowledge your material as the original source:

(Give book reference according to the APA style)

I (we) will deeply appreciate your signing the permission form in the duplicate copy of this letter and returning it at your earliest convenience. You may keep this copy of the letter for your files.

Yours sincerely,

.....

I (we) grant permission to reproduce the material specified above.

Date ..... By .....

Figure 20.1. Model letter requesting permission to use copyrighted material.

Another type of clearance is required before final production for photographs, video tapes, and films of all living persons. Such a release is required even from friends and students as long as they are recognizable. In the case of minor children, the release must be obtained from the parents. You should reassure parents of handicapped children that the material will not be used in any derogatory manner. A model release form is shown in Figure 20.2.

I hereby give permission to (your name or name of the institution producing the instructional material) to make pictures (film clips, video recordings) of me (my minor child (name of child)), and use the finished product for any legitimate purpose without limitation.

Date: _____

Signature _____

Name _____

Address _____

_____

_____

Figure 20.2. Model release form.

Copyright considerations

With the extremely thin market for teacher-training materials in special education, it is unlikely that a developer will grow rich on royalties. Copyright is important, however, to prevent instructional material from being illegally exploited. There follows a brief introduction to the copyright procedure.

The owner of a copyright is granted exclusive rights to sell, distribute, translate, or transfer into other media the material which he has developed. Copyright is granted only to published materials, that is, to those made available to the public, but all unpublished materials automatically come under the protection of the common law literary property provisions. Contrary to common belief, only the author or his agent may rightfully copyright the material he has developed. In the case of writers and instructional developers working on a project, the law clearly states that it is the employer, not the employee, who is regarded as the author. Normally, copyright protection lasts for 28 years and is renewable for another period of the same duration.

What may be copyrighted?

Depending upon the format and media, instructional material may fall into different classes as defined by the Copyright Office. (See Title 17, *United States Code.*) Textbooks, objectives outlines, resource lists; tests for criterion-based formats; rules, directions, and scripts for games, simulations, and roleplays; programed instructional materials, information-mapped books, and handouts; and printed illustrations and charts, all come under Class A. Training modules which are predominantly slides or filmstrips come under Class J. Scripted or mini-

mum-structure protocols come under Class L, and edited excerpts fall under Class M. The types of instructional materials which cannot be copyrighted include reprints of public documents (e.g., special education legislation), and blank tables and forms (e.g., forms for use in resource-management formats) which are designed for recording rather than conveying information.

USOE copyright program

Projects funded by the Office of Education must adhere to the USOE Copyright Program. They are outlined in the following two pamphlets:

U.S. Office of Education copyright program information. U.S. Department of Health, Education and Welfare, National Center for Educational Communication (U.S. Government Printing Office, Superintendent of Documents Catalog No. HE5.211:11031-A, 1971).

Office of Education copyright guidelines. U.S. Department of Health, Education and Welfare, National Center for Educational Communication (Government Printing Office 899-601). Reprinted from the Federal Register, **35** (91), May 9, 1970.

Basically, this program provides the right to copyright to the developer for a short period during developmental and field-testing stages, and to the disseminator for a specific limited period (usually seven years). Beyond this period, all materials developed through federal funding become public domain.

How to obtain copyright

The first step is to insert in the final version a copyright notice that includes the term *copyright*, the symbol ©, the name of the copyright owner, and the year of publication. In printed materials this notice should appear on the title page or its reverse side; in mediated materials it should accompany or immediately follow the title. Immediately after the final production of your instructional material, obtain the appropriate form from the Registrar of Copyrights, Library of Congress, Washington, D.C. 20540. Return the completed form with the fee and the number of copies specified for the class of materials.

Production standards

When the decision is made to disseminate the instructional material widely, production standards must automatically be raised. Gliessman (1972) pointed out that "Patently 'home made' tapes and films will not do. The developers of the pilot . . . materials have in large measure rejected the naive assumption that users will overlook technical inadequacy . . . for the sake of having 'conceptually sound' materials. Fortunately or unfortunately, the professional consumer probably reacts to technical quality as quickly and surely as he may to conceptual quality. The fact that the developer is producing materials that are unique conceptually does not allow him to 'beg' technical standards" (p.7).

If a production is of fairly high technical quality, the final production may just require commercial duplication; if the products are shabby, however, the commercial producer may have to begin from

scratch. In any event, more work must still be done. In the publication of printed materials, for example, the manuscript must be typed, edited, and shipped to the publisher before the deadline; illustrations prepared; photographs reproduced; model releases and permission to quote obtained; type style, layout, and binding selected; galley and page proofs corrected; an index prepared; and copyright obtained. In the final production of a film, one must specify length, color or black and white, synchronized or wild sound, and optical effects; produce or edit the script; suggest modifications on the rough cut and synch, effect, narration, and music tracks; inspect the answer print and approve optical effects, animations and titles, optical sound track quality, and suggest color corrections; and recheck the final version of the film.

Other desirable qualities for Instructional materials

In addition to high technical quality, a number of other characteristics are associated with widely disseminated instructional materials. Extrapolating from the findings of Rogers and Shoemaker (1971) in noneducational contexts and from the American Institute for Research (Crawford, Kratochvil, & Wright, 1972) in general educational contexts, four characteristics of instructional materials can be identified as essential for gaining wide acceptance in classrooms.

1. **Face validity.** The instructional material should not only be relevant to the needs of teacher trainees and trainers but also appear to be so obviously. Face validity of the package can be increased by displaying its goals, objectives, and relevance in salient places. Expert opinion about the material and positive reviews in professional journals encourage its acceptance.

2. **Completeness.** Self-contained instructional packages are more widely accepted than isolated components. Total-package developmental testing will also help identify missing components. Make sure that all elements are of equally high technical standards. Nothing is more disappointing than a dittoed sheet in the midst of a slick package.

3. **Flexibility.** A number of otherwise effective instructional packages are not used as widely as they deserve to be because they deal with a lengthy topic in a rigid fashion. Most successful packages permit local variations in their use and include a small component for a trial use before the entire package is adapted. If your instructional material contains a number of independent units, they should be made available on an individual basis.

4. **Ease of use.** As far as possible the instructional material should be packaged to permit easy use. Thus, all unnecessary media requirements should be avoided. A comprehensive instructor's manual will go a long way toward simplifying the use of the material. As pointed out earlier, such a manual should not be added as an afterthought but should be designed as an integral part of the instructional package and field tested along with other components.

We have examined a relatively large number of instructional materials developed by special education teacher trainers. Our experience leads us to caution the potential developer to exert particular attention to the need for making instructional packages independent of their developers, that is, they must be usable in the absence of the developer. Exportable packages must be usable without the necessity to communicate with the developer beyond the contents of the package.

Publicizing the Availability of the Instructional Material

We shall not attempt here to give you specific guidelines for writing advertisement copy. However, remember that the initial evaluation of a material is often made by reading a publisher's description or inspecting a small, sampler kit. As Hull and Wells (1972) pointed out, the purpose of such descriptive literature on instructional materials is to clarify what it is, why it was developed, how it works, who can use it, when to use it, and what it is not.

Chapter 21
Diffusion*

Objectives

1. Describe how the diffusion of new instructional products is accomplished through *dissemination, demonstration,* and *adoption facilitation.*
2. Incorporate the following in the dissemination of a new instructional package: audience analysis, strategy for gaining acceptance of ma[illegible], timing, and media.
3. Plan demonstration activities to encourage acceptance of new instructional products.
4. Draw up a strategy for assisting the user in implementing a new instructional program.

Several professional organizations concerned with special education are currently engaged in a variety of diffusion activities. Since developments in the field are so rapid, a summary of the status of these activities would be quickly outdated. However, it is important to note that among the organizations engaged in or actively promoting some level of diffusion activity, is the Council for Exceptional Children (CEC), the Teacher Education Division of CEC, the Leadership Training Institute Special Education at the University of Minnesota, the recently reorganized national network of Regional Resource Centers and Area Learning Resource Centers, and the National Center on Educational Media and Materials for the Handicapped. The Bureau of Education for the Handicapped, U.S. Office of Education, plays a central role in many of these efforts through federal sponsorship of programs and active encouragement of diffusion of innovations to the field. Nevertheless, the diffusion stage of the instructional development process is most likely to be either unfamiliar to or neglected by special education teacher trainers and training program developers. This concluding chapter discusses diffusion and materials utilization in order to acquaint the reader with the basic principles of diffusion and adoption and with some of the major issues raised by these activities.

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*This chapter was written for the Sourcebook by Dr. Alice R. Jwaideh, Division of Instructional Systems Technology, School of Education, Indiana University, Associate Professor, IST, and diffusion specialist for the Center for Innovation in Teaching the Handicapped.

What Is Diffusion?

Diffusion is the process through which a new idea or product becomes accepted and assimilated, that is, "adopted," by an individual, a group, or a system. The three basic functions involved in diffusion are (a) dissemination, (b) demonstration, and (c) facilitation of adoption.

The diffusion process differs in many ways from the processes of development and production. Usually it increases in intensity as the other processes near their culmination. After an instructional package has been designed, further activities are needed to gain its acceptance and adoption. The most effective solutions to practical problems in teacher training can have no effect unless they are diffused to the level of the practitioner and adopted by him.

The specific activities to be performed in diffusing a new instructional product or method differ considerably depending upon the innovation, the characteristics of the potential users, and the situation. Thus, in different situations, there may be relatively greater or lesser emphasis on aspects of diffusion involving the roles of information conveyor, demonstrator, promoter, or consultant. In nearly all cases, however, the job of the diffuser is to link or bring together the improved products, materials, and practices—that is, the innovations—with the practitioners who might benefit from their use. He accomplishes this through the three basic functions: dissemination, demonstration, and facilitation of adoption.

The *dissemination* aspect of diffusion involves spreading awareness among practitioners of the existence and general nature of an innovation. This task goes beyond merely imparting information; it involves the affective domain, for the disseminator must create a desire for the change, provide encouragement, and, if possible, arouse genuine enthusiasm on the part of potential users.

Through *demonstration*, practitioners are given an opportunity to examine and assess the new product and build up conviction of its suitability and effectiveness. The demonstration should provide a real chance for practitioners to gain experience with the innovation in a setting similar to that in which they would use it.

Facilitation of adoption involves helping the adopter to incorporate the innovation into the functioning system and providing him with the necessary assistance and support to maintain it. Therefore, consideration must be given to such factors as providing the necessary funds, materials, and equipment required by the innovation; adapting it to meet specific needs; training personnel to use it; and providing continuing evaluation of its effectiveness.

1. Dissemination

Audience analysis. Usually, the first step in planning a dissemination program is to decide upon the audience or audiences to whom the message will be directed. In disseminating information about teacher training packages, the audience could be any one or more of the following groups: university special education programs, teacher education consortia, school administrators, teachers, teachers' organizations, students, parents, community groups, state department of education personnel, curriculum committees, and specialists in various disciplines concerned with the education of the handicapped.

After identifying the audiences to be reached, a careful analysis should be made of the characteristics

of the members of each audience, including their attitudes, values, and needs. The characteristics of potential users must be kept in mind in devising promotional or publicity material aimed at diffusing innovative products.

Determination of strategies and themes. A diffusion "strategy" is an overall design for gaining acceptance of an innovation. Guba (1967) has developed the following classification of strategies, based upon assumptions about the audience:

- ☐ *Value strategy*, which views the potential adopter as a professionally oriented person who can be obligated to adopt through an appeal to his values.
- ☐ *Rational strategy*, which views the potential adopter as a rational entity who can be convinced, on the basis of hard data and logical arguments, of the innovation's utility (i.e., its feasibility, effectiveness, and efficiency).
- ☐ *Didactic strategy*, which views the potential adopter as willing to adopt but untrained to use the innovation; that is, he has the appropriate values, motivations, and economic resources, but does not know how to perform.
- ☐ *Psychological strategy*, which views the adopter as a psychological entity whose needs for acceptance, involvement, and inclusion can be employed to persuade him to adopt.
- ☐ *Economic strategy*, which views the adopter as an economically oriented entity who can be influenced to adopt.
- ☐ *Authority strategy*, which views the adopter as a member of a bureaucratic system who can be compelled to adopt by virtue of his relationship to an authority hierarchy.

In planning dissemination activities, the disseminator should attempt to select the appropriate strategy to persuade each of his audiences to consider, try, or adopt the innovation. He should make this selection not only on the basis of his assumptions about the audience's characteristics, but also on the basis of such considerations as his particular diffusion objectives, the nature of the innovation itself, the resources available for carrying out the diffusion effort and, of course, his personal style.

The determination of specific themes to use will be based on similar considerations. Examples of some general types of themes that have been used frequently in disseminating educational innovations include the following:

- ☐ *Child-centered*, emphasizing that the change will benefit students.
- ☐ *Financial*, emphasizing that the innovation will be economical in terms of benefits received.
- ☐ *Trainer-centered*, emphasizing that the innovation will conserve the trainer's time or energy.
- ☐ *Community-centered*, emphasizing that the innovation will benefit the community or society as a whole.
- ☐ *Educational currency*, emphasizing the desirability of keeping abreast of current educational practices.
- ☐ *Leadership*, emphasizing the training program or school district's reputation for leadership, or the prestige of being one of the first to introduce the proposed change.

Timing. In addition to deciding upon strategy and themes, the disseminator must also plan the timing of the dissemination program. For each audience, he must determine the precise time at which the program should begin, and the times at which

various items of information should be presented.

In planning the timing of dissemination activities, it is important to keep in mind the steps or phases which adopters usually pass through in the course of deciding whether to adopt or reject an innovation. Comprehensive attention to each of these phases has been found to maximize the effectiveness of diffusion activities.

The adoption process has generally been viewed as consisting of five phases:

1. *Awareness*, or first knowledge of the existence of an instructional material.
2. *Interest*, or actively seeking further information about the material.
3. *Evaluation*, or forming a favorable or unfavorable attitude toward the material. (This phase may be regarded as a subjective appraisal of the material.)
4. *Trial* of the material, on either a temporary or partial basis. This phase is an informal validation testing by the consumer.
5. *Adoption* (deciding to make full use of the material as the best course of action available), or *rejection* (deciding not to adopt the material).

It should be noted that these various phases may not always occur in the above sequence and, in some cases, one or two of them may seem to be skipped entirely. Nevertheless, extensive research indicates that the adoption of a new idea or product requires time and involves distinct phases or steps. The disseminator, therefore, should attempt to keep "in phase" with his audience. In most cases, he should not neglect the initial phase of arousing the interest of and motivating the potential adopter prior to providing him with detailed information about the material. He perhaps should not push a "trial" of the new product while the user is still seeking basic information. And he should not continue to work on the interest-arousing phase when the prospective user has already tried out the material and is ready to adopt it. In other words, it is helpful for the disseminator to accurately appraise the phase of the change process which the client has reached and design his messages accordingly.

Selection of dissemination media. In disseminating a new product, a number of communication channels or media can be used. These include the periodicals aimed primarily at specialized audiences, such as *The Journal of Teacher Education*, or the *Newsletter of the Teacher Education Division of CEC*; conferences, meetings, and conventions of various kinds; direct mail access to members of selected organizations through their membership lists; and direct contact with practitioners. In some situations, mass media channels are effective for disseminating an innovation; in other situations, interpersonal channels of communication may be more effective.

The main advantage of mass media is that they can reach a large number of persons rapidly. They tend to be more effective at the awareness stage of adoption, and they are more effective for earlier than for later adopters. Their major disadvantages are that they are impersonal and that the recipients can expose themselves only to what they want to hear or see, easily shutting out or forgetting those messages with which they disagree.

Ideas often seem to spread best and have the greatest impact when people talk to one another. Thus, in addition to using the traditional kinds of communications media, the disseminator should attempt to make maximum use of interpersonal communication channels that involve face-to-face ex-

changes between two or more individuals.

In disseminating an innovation, interpersonal channels tend to be especially effective at the evaluation and trial stages of adoption. Compared to mass media, interpersonal channels are much more capable of changing strongly held attitudes. It may be essential to use them when one encounters resistance or apathy toward a new product. Other advantages of interpersonal communication are that it permits the communicator to select his own audience, detect inattention, correct misunderstandings, provide clarification, and obtain immediate feedback on the recipient's reactions. The main disadvantage of the interpersonal approach is that it is relatively slow for reaching large numbers of people.

The use of interpersonal channels can be greatly enhanced through the identification of opinion leaders—those individuals within the group who are more active than others in introducing new information into the communication network, and who exert a disproportionate amount of influence on other group members. Such persons tend to rely for information on sources external to their group; often they are more likely than other group members to attend conventions, travel, be in touch with outsiders, and have an interest in new information and ideas. Opinion leaders also tend to maintain a high level of social participation within their groups and often (although not always) are in a position of slightly higher status than those they influence. For these reasons, opinion leaders can provide access to one's audience and its interpersonal communication network, and thus serve as valuable "links" between the disseminator and potential adopters.

Dissemination criteria

The disseminator should try to evaluate the effectiveness of his dissemination efforts. He should ascertain what action, if any, prospective adopters have taken, and he should plan ways of making further approaches to persons not yet "sold" on the innovation.

Criteria for effective dissemination

- ☐ *Clarity.* Information should be clearly stated, with a particular audience in mind.
- ☐ *Validity.* The information should present a true picture.
- ☐ *Pervasiveness.* The information should reach all of the intended audience.
- ☐ *Impact.* The information should evoke the desired response from the intended audience.
- ☐ *Timeliness.* The information should be disseminated at the most opportune time.
- ☐ *Practicality.* The information should be presented in the form best suited to the scope of the project, considering such limitations as distance and available resources.

2. Demonstration

A demonstration may be defined as an activity in which the participants observe planned, carefully presented examples of real or simulated behavior illustrating certain techniques, materials, equipment, and procedures as they might realistically be employed (Harris, Bessent, & McIntyre, 1969). The examples in this section are from demonstrations of materials at the inservice level, but the principles are applicable to preservice training programs as well.

Many experts regard demonstration as a very important part of the diffusion process. It has even been said that it is the most effective way of convincing educators of the value of a new product. In his well-known study of educational change in New York state, Brickell (1961) asked hundreds of teachers and administrators what it took to persuade them to try an innovation that was being used in another school. The consensus was that the best way to judge an innovation was to see it in operation. Brickell concluded:

> Speeches, literature, research reports and conversations with participants outside the actual instructional setting are interesting but relatively unconvincing. IMPLICATION: Recommended new programs must be demonstrated so that they can be observed in action (p. 27).

Several types of demonstrations can be presented in several kinds of contexts. A new product or set of materials can be demonstrated in a special "demonstration center" set up specifically for that purpose. In some cases, a particular training program in which an innovation is being implemented can be designated as a "demonstration school." In disseminating new curriculum materials, the Eastern Regional Institute for Education (Mahan, 1970) made wide use of "demonstration day" programs. On such specified days, teachers from various schools were invited to spend an entire day at a host school where the new materials were already in use. Within a single institution, "demonstration lessons" may be presented, that is, other trainers may be invited to observe the use of a new set of training materials. Demonstrations can also constitute an important part of inservice programs, such as workshops, institutes, and conferences.

A demonstration can serve various purposes. It can be used to inform observers of new materials and techniques, thus creating awareness; it can help to develop an understanding of the items being shown and explained; and it can help to arouse interest in the use of these items. Perhaps the most important function of a demonstration, however, is to *build conviction* of the feasibility and usefulness of an innovation for the potential adopter.

To accomplish these purposes effectively, a demonstration should meet the following criteria:

Convenience. The demonstration should be conducted at a site within a reasonable distance of the intended audience and should be easily accessible.

Evidential assessment. The demonstration should provide an opportunity for potential adopters to examine and assess the operating qualities of the innovation. Accurate assessment is possible only if the demonstration provides evidence that can be examined thoroughly, critically, and personally. Moreover, the demonstration should illustrate both positive and negative factors related to the innovation and its implementation so that an observer can reach a valid professional judgment on its utility for him (Clark & Guba, 1965).

Credibility. The demonstration must be convincing and compelling. Consequently, it must be conducted in a situation that is very similar to that in which it would be used by the potential adopters. As Brickell (1961) pointed out, anything abnormal, unreal, or artificial in the circumstances surrounding an observed program —that is, anything appreciably different from conditions in the visitors' own school system— can rob the demonstration of its persuasive effect. Observers tend to be very sensitive to any distinctive characteristics of the host school, such as the pupils' mental ability, financial support, physical facilities, teacher characteristics, and so forth. If these characteristics are unlike those of his school, he will tend to attribute the apparent success of the program to these differences.

Planning a demonstration. As indicated, the location of the demonstration is extremely important; it should be selected to offer maximum convenience and credibility. In addition, if a school is to be the site of the demonstration, it should be selected on the basis of such factors as its leadership and policies toward experimentation, the attitude of the school board and the facilities available.

Another important task is to select a person (or persons) to conduct the demonstration. He must have considerable skill, knowledge, flexibility, interest, and enthusiasm. It has been found that demonstrations by peers are more effective than demonstrations by high-status persons. Often it is best to use teachers as the demonstrators, especially if curriculum materials and students are involved, and if the observers themselves are teachers. The arrangements for the demonstrations can, of course, be made by persons other than the developer.

In selecting participants for the demonstration, attention should be given to the optimum group size. The problem of having too many persons in attendance must be weighed against the disadvantages of having too few. The optimum size of the group depends, in part, upon the size of the objects and movements to be demonstrated. Thus, sometimes 5 or 10 persons will be enough but sometimes 40 or 50 will be desirable.

Do not invite "just anyone". Select persons who can and will profit from the demonstration. They can be chosen on the basis of interests and expressed or diagnosed need. Sometimes it is advisable to include high-status persons who can provide follow-up support after the demonstration.

Attention should be devoted to preparing an effective letter of invitation which should be mailed out with the registration forms. If possible, send out in advance a descriptive article or brochure or other orientation materials that provide background information about the innovation to be demonstrated.

Prepare a detailed plan of the demonstration itself, following these preparatory steps.

1. Outline the sequence of events in detail.
2. Review and revise the outline.
3. Prepare the materials and equipment that will be needed before and after the demonstration and during each event, including such resources as space, facilities, and personnel.
4. Stage a "dry run" of the demonstration before a few persons who can suggest refinements.
5. Prepare a final revision of the demonstration plan according to a carefully developed time schedule and incorporate it in a printed program or agenda.

Follow-up activities. Follow-up activities are often planned for immediately after the demonstra-

tion while impressions are still vivid and interest is high. Possible follow-up activities include the following:

Discussion of techniques, procedures, and materials observed. It is usually best to provide for the answering of questions, as well as discussion, explanations, and analysis, *after* the demonstration rather than during it. This recommendation is especially true if explanatory comments during the demonstration would detract from the realism of the situation.
Laboratory sessions, in which the observers, sometimes in a group, attempt to do what they have seen demonstrated.
Directed practice sessions, in which the individual observer is guided in his efforts to do what has been demonstrated.
Interviews with observers to plan ways of using demonstrated procedures or techniques in a real situation.

Several kinds of follow-up activities also may be desirable after the observers have returned to their home schools. One of the most valuable steps is to provide them with assistance to implement the observed procedures. This type of follow-up support would undoubtedly do much to increase the effectiveness of the demonstration as a diffusion method.

Evaluation. A final but important task is to evaluate the participants' reactions, both at the time of the demonstration and later, sometime after they have returned to their school situations. Often, a simple evaluation instrument is prepared for participants to fill out at the end of the demonstration program. An even more important evaluation task is to determine the extent to which the innovation has actually been adopted as a result of the demonstration. Data relevant to this question can be obtained through follow-up letters, telephone calls, personal visits to school district offices, examination of in-service workshop rosters, and, in some cases, regional salesmen or distributors of the new materials. Another type of follow-up activity that may prove profitable is to arrange some form of interaction with potentially interested persons who were invited but unable to attend the demonstration.

Guidelines for maximizing the effectiveness of a demonstration.

- ☐ Offer the observers something new or different or, at least, more highly refined than that with which they are already familiar.
- ☐ Encourage team attendance, if possible. Try to have several persons from the same university or school district attend the demonstration, instead of just one from each institution.
- ☐ Design the demonstration to make maximum use of viewing; use listening as a supporting element.
- ☐ Arrange in advance for adequate facilities, including good lighting and acoustics, sitting or standing room for good viewing, a physical setting that can be staged to approximate reality, and microphones that can be suspended over the demonstration area.
- ☐ Design an observation instrument to encourage note-taking.
- ☐ Introduce the demonstration briefly; give needed information for meaningful observation; tell the audience why it is observing, what to look for, and how to observe.

- ☐ Arrange for newspaper or television publicity.
- ☐ Use persons other than the demonstrator for follow-up activities to avoid the problems of fatigue, emotional involvement, and role shift. Follow-up leaders should be selected, trained, and briefed in advance.
- ☐ Arrange for coffee or other refreshments at the beginning of the meeting; where possible, make allowances for smokers.
- ☐ Permit and encourage free verbal interchange with classroom teachers who have used the innovation.
- ☐ Avoid formal presentations by outside experts and too much participation by representatives of educational change agencies.

With regard to the last two points, the Eastern Regional Institute for Education (ERIE), in its publication entitled *How to plan a curriculum demonstration day* (Mahan, 1970), reported that feedback from evaluation questionnaires, completed by demonstration day visitors,

> . . . tended to underscore the impact of observation of classroom teaching and free verbal interchange with classroom teachers. . . . They did not come to be lectured at or to discuss theoretical frameworks for educational change. They came to see and to get the facts from teachers for whom the new curriculum was an everyday classroom reality (p. 25).

In addition, the ERIE demonstration day programs provided the opportunity to question the pupils who were observed and witness the administration of a competency measure. Plenty of time was available to question the principal about such aspects of the program as time considerations, costs, relation to the total curriculum, inservice training requirements, and so forth. Also scheduled were give-and-take sessions among visitors, principals, and several teachers, and a well-written summary article about the innovation was distributed to be taken home.

Advantages and disadvantages of demonstrations. The demonstration has a number of advantages as a type of diffusion activity. A primary one is that it permits observation and provides an opportunity to evaluate the innovation before it is tried out. Also, the demonstration is a highly visible and publicizable technique; it stimulates activity and involvement on the part of potential users; and it reinforces the adoption behavior of the demonstrator himself (if he is a user) through the public commitment he makes by demonstrating the innovation.

Demonstration has some limitations, however. Although the demonstration may be useful to develop knowledge, understanding, interest, and perhaps even conviction, it is not feasible for the development of actual skills as usually the audience merely observes. Another limitation is that only a relatively small number of persons can be influenced through a demonstration because the size of the audience must be limited. Also, demonstrators may overemphasize the success of the innovation and play down the difficulties and possible failures. Finally, a demonstration that fails may have a very negative effect on a change effort. Nevertheless, as Havelock (1969) pointed out, if the failure is due to the complexity and real difficulties inherent in the innovation itself, rather than to the sponsor's failure to plan and carry out the demonstration effectively, actual benefits may accrue.

3. Facilitating adoption

In addition to disseminating and demonstrating a new instructional product, sometimes the diffuser also has the responsibility of helping the adopter to put it into practice or install it. This responsibility involves two major kinds of objectives: (a) "operationalizing" the innovation, that is, adapting it to the specific conditions and needs of the adopting institution; and (b) "institutionalizing" it, that is, establishing it as an integral part of the ongoing program. This section is concerned mainly with the latter objective.

Gaining acceptance and support

The diffuser can facilitate adoption in a variety of ways. In preparing for the initial use of an innovation within a particular system, it is helpful first to get the support of key administrators and staff members. An attempt should then be made to identify other persons who are favorably disposed toward the innovation. Most experts agree that initially it is usually best to work with those parts of the system that desire to change.

Attention should also be given, however, to winning over important individuals who are opposed to the innovation. In dealing with opponents, it may be desirable to (a) include them, if possible; (b) make their participation voluntary, if possible; (c) if they say it's nothing new, get them to help others; (d) attempt to alleviate their fears about the innovation; and (e) consider alternative forms of the innovation which they might accept. Watson (1969) proposed the following list of guidelines for overcoming resistance to change:

Guidelines for overcoming resistance to change*

Who Brings the Change?

1. Resistance will be less if administrators, teachers, Board members and community leaders feel that the project is their own—not one devised and operated by outsiders.
2. Resistance will be less if the project clearly has wholehearted support from top officials of the system.

What Kind of Change

3. Resistance will be less if participants see the change as reducing rather than increasing their present burdens.
4. Resistance will be less if the project accords with values and ideals which have long been acknowledged by participants.
5. Resistance will be less if the program offers the kind of *new* experience which interests participants.
6. Resistance will be less if participants feel that their autonomy and their security is not threatened.

Procedures in Instituting Change

7. Resistance will be less if participants have joined in diagnostic efforts leading them to agree on what the basic problem is and to feel its importance.
8. Resistance will be less if the project is adopted by consensual group decision.

*Watson, Goodwin, "Resistance to Change," in W. G. Bennis, *et al*, *The Planning of Change*. N. Y.: Holt, Rinehart & Winston, Inc., 1969, p. 487.

9. Resistance will be reduced if proponents are able to empathize with opponents; to recognize valid objections; and to take steps to relieve unnecessary fears.
10. Resistance will be reduced if it is recognized that innovations are likely to be misunderstood and misinterpreted, and if provision is made for feedback of perceptions of the project and for further clarification as needed.
11. Resistance will be reduced if participants experience acceptance, support, trust, and confidence in their relations with one another.
12. Resistance will be reduced if the project is kept open to revision and reconsideration if experience indicates that change would be desirable.

Planning for Implementation

In addition to gaining as wide acceptance of the innovation as possible, it is advisable to draw up a detailed plan for implementing the innovation. The implementation plan might consider such questions as the following:

1. Sources of funds for installing and maintaining the innovation.
2. Provision of the necessary facilities, equipment, and materials.
3. The gaining of community support, when needed.
4. The feasibility of a small-scale trial of the innovation involving a limited number of personnel and resources.
5. Provision of external consultants and other outside resources.
6. Structural and procedural changes in the system that may be required for the innovation to succeed (e.g., grading practices, class composition, time allocation).
7. Procedures for continuing evaluation and feedback on the innovation.
8. Assignment of specific responsibilities for implementation.
9. Released time or reduced teaching loads for persons directly involved with the innovation.
10. Providing supportive assistance and encouragement to those undertaking the new program (e.g., through praise, recognition, and other rewards).

Involving Staff Members

Whenever possible, all persons who will be affected by the innovation should participate in the planning. Research has shown that, in most cases, involving the entire staff in implementing an innovation greatly increases the likelihood that it will be accepted.

The diffuser should be aware of the variety of techniques that are available for group discussion and interaction. Some of these techniques are especially useful for conveying information, others for arousing interest, and others for arriving at a group decision. An excellent description of these different methods, including their uses, advantages, and dangers, as well as a step-by-step account of how to implement each, is given in *Leadership and Dynamic Group Action* (Beals, 1962). The methods covered in depth by Beals include large group discussions, the huddle method, "buzz" groups, panel discussions, interrogator panels, committee hearings, and role-playing.

Workshops and Inservice Activities

The use of workshops and inservice training is a diffusion technique of great importance. Many new kinds of instructional approaches, techniques, and materials require special skills which teachers do not obtain in the course of their regular training. The lack of the required training and skills is frequently the cause of the failure or discontinuance of an innovation that previously had been adopted, sometimes with initial enthusiasm, by teachers. Since a number of useful publications are available that deal with inservice education, this section provides only a very brief overview of some of the major factors to be considered in utilizing workshops as a diffusion technique.

The first step in planning a workshop or other training program is to formulate one's objectives and then to decide on a suitable means (i.e., activities) to achieve them. The term "objective" implies that the program should have some predetermined result that may be expressed in terms of people's behavior. Harris et al. (1969) have classified the objectives or outcomes of inservice programs into the following types: knowledge, comprehension, application, synthesis, values and attitudes, and adjustment. A variety of activities are possible, including lectures, demonstrations, observation, interviewing, brainstorming, group discussions, buzz sessions, role-playing, and guided practice (playing the role in a real situation).

The choice of a workshop director is very important; the success of the program depends in large measure on his leadership, organizational ability, and innovativeness. A carefully developed plan is desirable, but it should be sufficiently flexible so that it can be modified in accordance with unanticipated problems and the wishes of the participants.

In planning an inservice program, as in the case of demonstrations, careful attention must be given to the provision of adequate facilities. For example, if the participants are to be divided into teams, each team should have a separate room where it can meet undisturbed. If possible, these rooms should be close enough to facilitate intergroup communication. It is often desirable to have another room nearby for typewriters, duplicating equipment, audiovisual equipment, and other aids. Audio and video tape recorders are useful to provide a permanent record of the program, resolve disagreements, and encourage self-analysis.

Attention must also be given to ensuring an audience of the desired size and composition. Incentives should be provided for attendance, such as emphasizing the program's usefulness to the participants, arranging for university credit, or providing stipends or reimbursement of tuition fees. Good publicity is often needed to attract the desired participants.

Remember that most teachers value the opportunity to acquire practical skills more than theoretical discussions. A continuing program of inservice training, with regularly scheduled sessions throughout the school year, may be much more effective than a single, one-shot effort. It is highly desirable, where possible, to arrange for teachers to get released time rather than extending the length of their working day by conducting inservice programs after school hours. In cases where workshops are to be conducted during the summer, planning for them should be started in November or December of the previous year to allow time for the necessary budgetary allocations, selection of a good director, and mailing preliminary information before teachers make other plans.

The diffuser should not view inservice training as

an isolated technique for bringing about the adoption of an innovation. Instead, he should consider all the organizational factors that need to be adjusted to give the proposed change a supportive environment (organizational rules or procedures such as grading practices, staffing patterns, grouping, resources, departmentalization, etc.). He should identify in advance all changes of this type that are required to meet the objectives of the inservice program.

For a detailed coverage of all of the many things to be considered in conducting an inservice program, the reader is referred to a publication of the Eastern Regional Institute for Education (ERIE), entitled *How to conduct a workshop . . .* (Ritz & Wallace, 1970). This report, which is now out of print, can be obtained through the ERIC system. It includes detailed flowcharts covering each of the following aspects of conducting a workshop: instructional program, funding and costs, staffing, materials, scheduling, site logistics, publicity and registration, college credit procedure, noninstructional activities, and evaluation.

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Glossary of instructional development terms

Specific definitions in this glossary relate to the development of instructional materials for teacher training in special education. The terms in other contexts may have broader applications.

adjunct programing A mastery-learning format that provides the trainee with a test on the content of some specified material (e.g., a chapter of the textbook) and a self-scoring device (e.g., punchboard). The trainee self scores the test and selectively restudies areas missed.

appropriateness Appropriateness of an instructional material is the extent to which its objectives and content are consonant with goals of teacher training in special education as judged by experts.

audiotutorial modules A self-instructional multimedia format that uses audiotape recordings as the integrating element. The trainee performs all activities suggested by the tape to attain the instructional objectives.

behavioral objectives Specification of the purposes of instruction in terms of desired terminal performance of the trainee. Behavioral objectives also specify the conditions under which this performance is to take place and the criteria for minimum acceptable performance.

branching programs The second most common type of programed instruction that checks the mastery of content through frequent use of multiple-choice questions. Depending upon the trainee's choice, he is referred to the next main frame or a remedial-instruction frame. Thus the sequence of frames varies from person to person depending upon performance.

computer-assisted remedial education (care) A computer-based instructional format, developed at the Pennsylvania State University, which is programed to present information both visually and auditorially and to accept trainee's responses through a typewriter keyboard or light pen.

computer-assisted repeated testing (cart) A computer-based instructional format in which various equivalent versions of the criterion test and answer key are generated by a computer and used in a mastery-learning situation.

computer-assisted teacher training system (catts) A computer-based format in which a trainee's teaching performance is coded on any standard observation system by trained observers and instantaneously processed and fed back to the trainee by a computer.

concept analysis A systematic procedure for the identification of major concepts to be taught to trainees, the interrelation of these concepts, and the critical and irrelevant attributes of each concept.

criterion-referenced tests A test designed to directly measure the trainee's attainment of specific instructional objectives. The trainee's performance in criterion-referenced tests is compared with standards specified by the objectives and not with the performance of others.

developmental testing A component of formative evaluation in which the instructional material is tried out with representative trainees to obtain feedback for the improvement of the materials.

diffusion The procedures for dissemination and distribution of completed instructional materials to users. The diffusion process also includes measures to assure that materials are adopted and used in training programs.

effectiveness Effectiveness of an instructional material is the extent to which instructional objectives are attained by trainees who work through the material.

entry level or behavior The level of relevant behavior at the beginning of instruction.

entry questionnaire A questionnaire administered prior to instruction to collect relevant educational and experiential data.

entry test A criterion-referenced test which is based upon the specification of prerequisite skills and knowledge. Entry tests determine if a trainee is ready to benefit from instruction.

evaluation design An experimental or quasi-experimental design for measuring the effectiveness and validity of an instructional material.

expert appraisal The process of obtaining expert opinion on technical and conceptual qualities of the instructional material from editors, subject-matter experts, and media producers. This information may be used formatively to improve the material or summatively to certify its quality.

feasibility Feasibility of an instructional material is the extent to which it is usable in teacher-training programs in special education.

field training A resource-management format that provides the trainee with behavioral objectives and references to instructional and human resources.

formative evaluation Evaluation of instructional materials and methods to collect useful information for improving their effectiveness.

format selection A systematic procedure for choosing an appropriate instructional format on the basis of learner characteristics, requirements of the instructional task, and dissemination factors.

front end analysis A systematic procedure for analyzing the underlying problems in a given field in terms of the discrepancy between the desired criterion and actual performance and for suggesting possible alternative strategies.

information mapping A self-instructional print format in which units of instructional content are presented in one of seven standard layout formats depending upon the type of learning involved; concepts, structures, processes, procedures, classification, facts, and proofs.

input measures Tests and instruments for the measurement of aptitudes, characteristics and entry behaviors of trainees prior to instruction.

instructional game A small group instructional format that involves competition between players (or teams) to reach a prespecified criterion through a series of moves which are controlled by rules of play.

instructional systems technology An applied science based on research on learning and communication that deals with the design, development, and evaluation of systems of materials and management strategies employing human and nonhuman resources for the efficient attainment of specific learning objectives.

internal validation One phase of validation testing for determining the extent to which an instructional material teaches what it is supposed to teach. It usually requires the administration of a posttest immediately after a group of trainees complete the instructional material and the measurement of their attainment of the instructional objectives.

learner analysis A systematic procedure for identifying those characteristics of the target population which are relevant to the design of instruction.

linear programs A type of programed instructional material that presents the instructional content in a fixed sequence. Traditional linear programs make extensive use of small steps, prompting and constructed response questions, and revise the material until a low error rate is achieved. Current linear programs tend to be lean with large frames and low rate of redundancy.

mastery-learning formats Instructional formats that permit and encourage the trainee to take the unit criterion tests repeatedly and provide him with formative feedback for remedial instruction.

media Any means for recording, storing, and distributing information. The term is used interchangeably to refer to materials (software), such as film or audiotape, and equipment (hardware), such as film projector or tape recorder.

media attributes Characteristics or capabilities of different media, such as the ability to show objects in motion, to present auditory and visual stimuli, and to permit random access.

media selection A systematic procedure for choosing appropriate medium (or media) on the basis of learner characteristics, requirements of the instructional objectives and dissemination factors.

minicourses A multimedia training format based on the micro-teaching technique. The method requires model films or videotapes, peer or classroom teaching by trainees, self evaluation of the videotaped performance, and reteaching.

objectives outline A resource-management format that provides the trainee with a set of hierarchically arranged behavioral objectives and entrusts him with responsibility for attaining them.

output measures Tests and instruments for collecting data on trainees' behaviors and attitudes as a result of completing an instructional material.

pacing The rate at which information is presented to the learner. Self-pacing indicates that the learner can control this pace (e.g., a printed book). Equipment pacing indicates that this rate is determined solely by the speech of the machine (e.g., a tape recorder replaying tape at the rate of 7½ inches per second).

paper-and-pencil test A test that measures the trainee's attainment of instructional objectives through printed questions which require choices or written responses.

payoff validation The final phase of validation testing in which the *effects* of newly acquired skills and knowledge are measured. For example, changes in children's reading behavior may be measured in order to validate some new teaching skills.

performance test A test that requires the trainee to demonstrate his attainment of an instructional objective through the actual performance of a task rather than a verbal description.

personalized system of instruction A mastery-learning format that requires the trainee to demonstrate mastery of one unit before moving on to the next. This format usually uses advanced trainees as test proctors and tutors.

posttest A criterion-referenced test that is administered after instruction to determine whether the trainee has attained the objectives of the instructional material.

pretest A criterion-referenced test that is administered prior to the beginning of instruction to determine the extent to which the trainee has already attained the objectives of the instructional material.

process measures Tests and instruments for collecting data on trainees' behaviors and attitudes as they work through an instructional material.

professional jurying The process of collecting and reporting expert opinion in order to decide whether an instructional material is ready for dissemination. The same information also provides potential users with objective appraisals.

protocols Records of real or realistic instructional behaviors designed to exemplify educationally relevant concepts.

programed instruction Currently defined as any piece of validated instructional material. Common usage of the term refers to a self-instructional print format that presents information in frames, requires the trainee to use the information in responding to a question, and presents immediate feedback on the correctness of the response.

random access Degree to which the medium permits the trainee to go directly to any specific part of an instructional presentation. The random access of printed materials is high, that of films is low.

rating scale An observation instrument that enables a judge to inspect the performance of a trainee or the product of such performance and to rate it objectively along a number of specified dimensions.

repeated testing A mastery-learning format with alternative instructional resources keyed to behavioral objectives. The trainee takes parallel versions of unit criterion tests which are evaluated by the instructor and returned with suggestions for remedial instruction. This procedure is repeated until satisfactory performance is obtained.

resource-management formats Instructional formats that provide directions for using existing textual, mediated, and human resources.

resource-list A resource-management format that provides the trainee with a set of behavioral objectives coded to various instructional materials. The trainee's mastery of these objectives is tested with appropriate criterion tests.

roleplay A small group instructional format in which the teacher trainees act out specific roles from an educationally relevant interpersonal situation.

scripted protocols Protocols produced by recording a scripted dramatization of instructional events to exemplify selected educational concepts.

sensory mode The sense through which the learner receives information. Auditory and visual modes are the predominant ones through which instructional information is usually presented.

sign type The relation between signs and symbols and the objects they represent. *Verbal* presentations use arbitrary signs (e.g., letters and numerals) while *nonverbal* presentations (e.g., pictures and photographs) use signs that resemble what they represent.

simulations An instructional format that involves a hypothetical representation of an educationally relevant situation. Various aspects of reality are differentially emphasized depending upon their relevance to the instructional objectives of the material.

summative evaluation Evaluation of instructional materials under specified conditions in order to measure and report their effectiveness.

target trainee or target population The group of learners for whom an instructional material is designed.

task analysis A systematc procedure for the specification of the main task to be performed by the trainee upon the completion of instruction, its analysis into subtasks, and their arrangement into learning hierarchies.

total-package testing Final stage of developmental testing in which the instructional material is tried out in actual training situations outside the supervision or control of the developer.

training material Instructional materials designed to help trainees acquire specific performance skills related to teaching.

transfer validation One phase of validation testing during which the extent of change in a trainee's performance as a result of his newly acquired knowledge and skills is determined. For example, the actual classroom teaching by the trainee may be systematically observed to measure his applications of various teaching skills.

validation testing Testing of the final version of the instructional material in order to demonstrate and document its effectiveness.

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